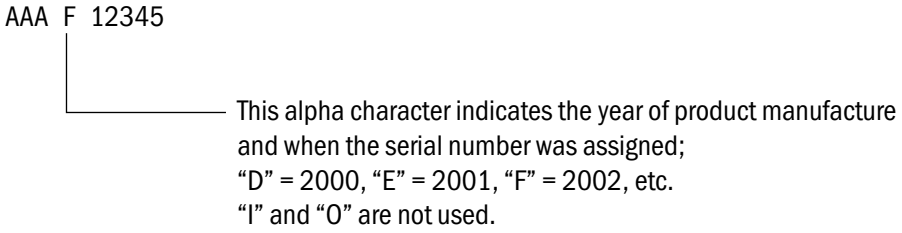
S/5 Aespire Anesthesia Machine

Technical Reference Manual

Datex-Ohmeda products have unit serial numbers with coded logic which indicates a product group code, the year of manufacture and a sequential unit number for identification.



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Covers the following:

S/5 Aespire anesthesia machine

S/5 Aespire 100 anesthesia machine

S/5 ProTIVA anesthesia machine

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Important

The information contained in this service manual pertains only to those models of products which are marketed by Datex-Ohmeda as of the effective date of this manual or the latest revision thereof. This service manual was prepared for exclusive use by Datex-Ohmeda service personnel in light of their training and experience as well as the availability to them of parts, proper tools and test equipment. Consequently, Datex-Ohmeda provides this service manual to its customers purely as a business convenience and for the customer's general information only without warranty of the results with respect to any application of such information. Furthermore, because of the wide variety of circumstances under which maintenance and repair activities may be performed and the unique nature of each individual's own experience, capacity, and qualifications, the fact that customer has received such information from Datex-Ohmeda does not imply in anyway that Datex-Ohmeda deems said individual to be qualified to perform any such maintenance or repair service. Moreover, it should not be assumed that every acceptable test and safety procedure or method, precaution, tool, equipment or device is referred to within, or that abnormal or unusual circumstances, may not warrant or suggest different or additional procedures or requirements.

This manual is subject to periodic review, update and revision. Customers are cautioned to obtain and consult the latest revision before undertaking any service of the equipment. Comments and suggestions on this manual are invited from our customers. Send your comments and suggestions to the Manager of Technical Communications, Datex-Ohmeda, Ohmeda Drive, PO Box 7550, Madison, Wisconsin 53707.

⚠ CAUTION Servicing of this product in accordance with this service manual should never be undertaken in the absence of proper tools, test equipment and the most recent revision to this service manual which is clearly and thoroughly understood.

Technical Competence

The procedures described in this service manual should be performed by trained and authorized personnel only. Maintenance should only be undertaken by competent individuals who have a general knowledge of and experience with devices of this nature. No repairs should ever be undertaken or attempted by anyone not having such qualifications.

Datex-Ohmeda strongly recommends using only genuine replacement parts, manufactured or sold by Datex-Ohmeda for all repair parts replacements.

Read completely through each step in every procedure before starting the procedure; any exceptions may result in a failure to properly and safely complete the attempted procedure.

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1 Introduction

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1.1 What this manual includes

Anesthesia Machine

This manual covers the service information for the S/5 Aespire line of anesthesia machines. It covers the following components:

- gas delivery components,
- breathing system components,
- frame component (except those strictly associated with a specific ventilator),
- optional suction regulator and auxiliary O_2 flowmeter.

Ventilator

The ventilator associated with the S/5 Aespire machine has its own Technical Reference Manual:

- for the7100 Ventilator see manual 1006-0836-000.

S/5 ProTIVA

The ProTIVA machine is configured with standard Aespire machine components, with the exception of the vaporizer manifold and the Ventilator/ Monitoring Display (7100 Control Module) mounting solution (refer to Section 8.5).

B Braun equipment is not covered in this manual. Refer to B Braun service documentation.

Other equipment

Other equipment may be attached to the system on the display mount, the top shelf, or on the side dovetail rails. Consult separate documentation relative to these items for details.

1.2 Standard service procedures

1.2.1 User's Reference Manuals

Some sections of this manual refer you to the User's Reference Manual for the S/5 Aespire. To expedite repairs, you must have, and be familiar with, the User's Reference Manuals for this product.

Refer to the S/5 Aespire User's Reference Manual if you need further information about the operation of the system.

1.2.2 Technical Reference Manuals

You must first determine where a problem is located before you can determine which Technical Reference Manual to use:

- Use this manual for machine and breathing system related issues.
- Use the 7100 Ventilator manual for ventilator related issues.

1.3 What is an S/5 Aespire

The S/5 Aespire is a compact, integrated and intuitive anesthesia delivery system. The ventilator portion provides mechanical ventilation to a patient during surgery as well as monitoring and displaying various patient parameters.

The system uses a microprocessor-controlled ventilator with internal monitors, electronic PEEP, Volume Mode, and other optional features. A serial interface permits communication to cardiovascular and respiratory gas monitoring.

Note Configurations available for this product depend on local market and standards requirements. Illustrations in this manual may not represent all configurations of the product.

The S/5 Aespire is not suitable for use in an MRI environment.

1.3.1 Aespire 100

The Aespire 100 machine is based on the standard S/5 Aespire machine with the following exceptions to available features or options:

- does not include the RS232 Serial Interface
- does not include the Bi-level LED light strip
- the 2 Vap manifold is standard (does not support 1 Vap manifold)
- not available with AC power outlets (area used by AC Inlet)
- uses 4-inch casters instead of 5-inch casters

1.3.2 S/5 ProTIVA

The S/5 ProTIVA is a special adaptation of the S/5 Aespire machine for use with B Braun intravenous drug delivery components.

1.4 Configuration options

1.4.1 Standard configuration

The standard configuration includes the following items.
Items marked with an asterisk (*) are not included in the Aespire 100 machine.

- 7100 Ventilator
- Advanced Breathing System (ABS)
- Auxiliary Common Gas Outlet (ACGO)
- Serial Interface - RS232*
- Bi-level LED light strip*
- Two large drawers

1.4.2 Options

Options include the following items.
Items marked with an asterisk (*) are not available in the Aespire 100 machine).

- selected software features
- vaporizer manifold (1 Vap* or 2 Vap)
- pipeline configurations (O_2/N_2O, O_2/Air, or O_2/N_2O/Air)
- gas cylinder configurations (two inboard, one outboard)
  - inboard configuration = O_2/N_2O, O_2/Air, or O_2/O_2
  - outboard configuration = N_2O only
- manual bag (on support arm or on tube)
- gas scavenging (active, adjustable, passive, or venturi)
- a suction regulator (pipeline vacuum or venturi vacuum)
- an auxiliary O_2 flowmeter
- localized electrical power outlets* (isolated or non-isolated)
- various display mounting solutions

1.5 Components

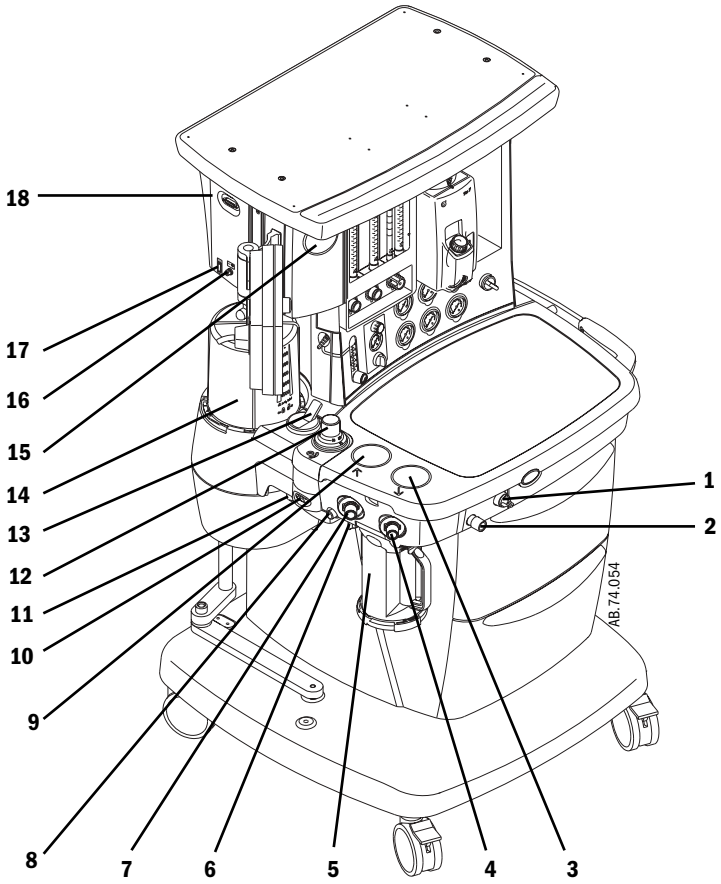
The following figures show the front and rear views of the machine.
There are some differences between models.

Figure 1-1 • S/5 Aespire (front view - left side)

Figure 1-2 • S/5 Aespire (front view - right side)

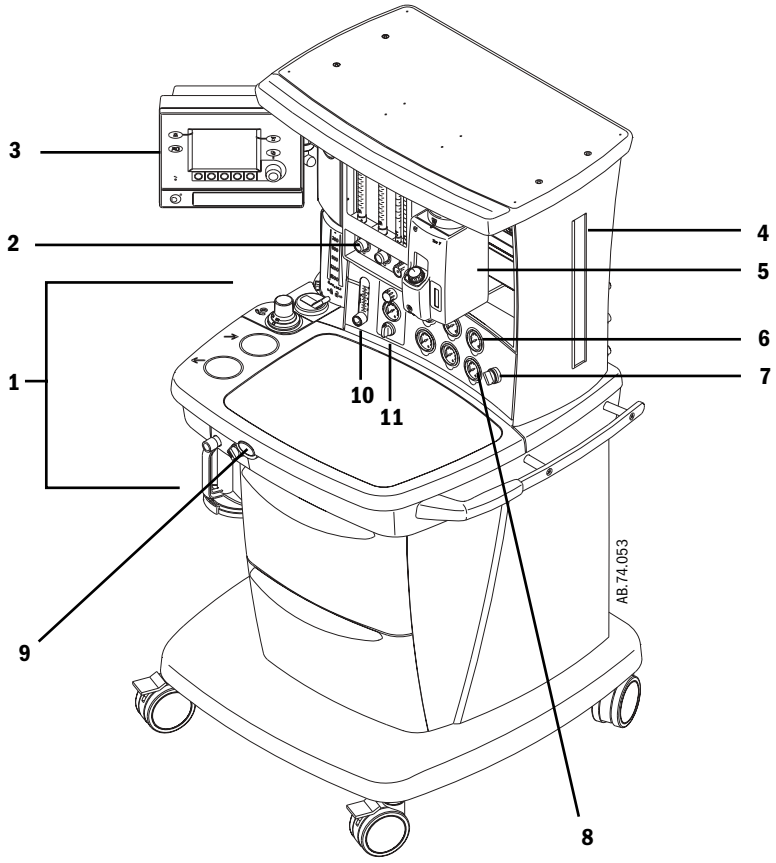
Figure 1-3 • S/5 Aespire (rear view)

Figure 1-4 • S/5 ProTIVA with a typical B Braun fluid manager (fm) system



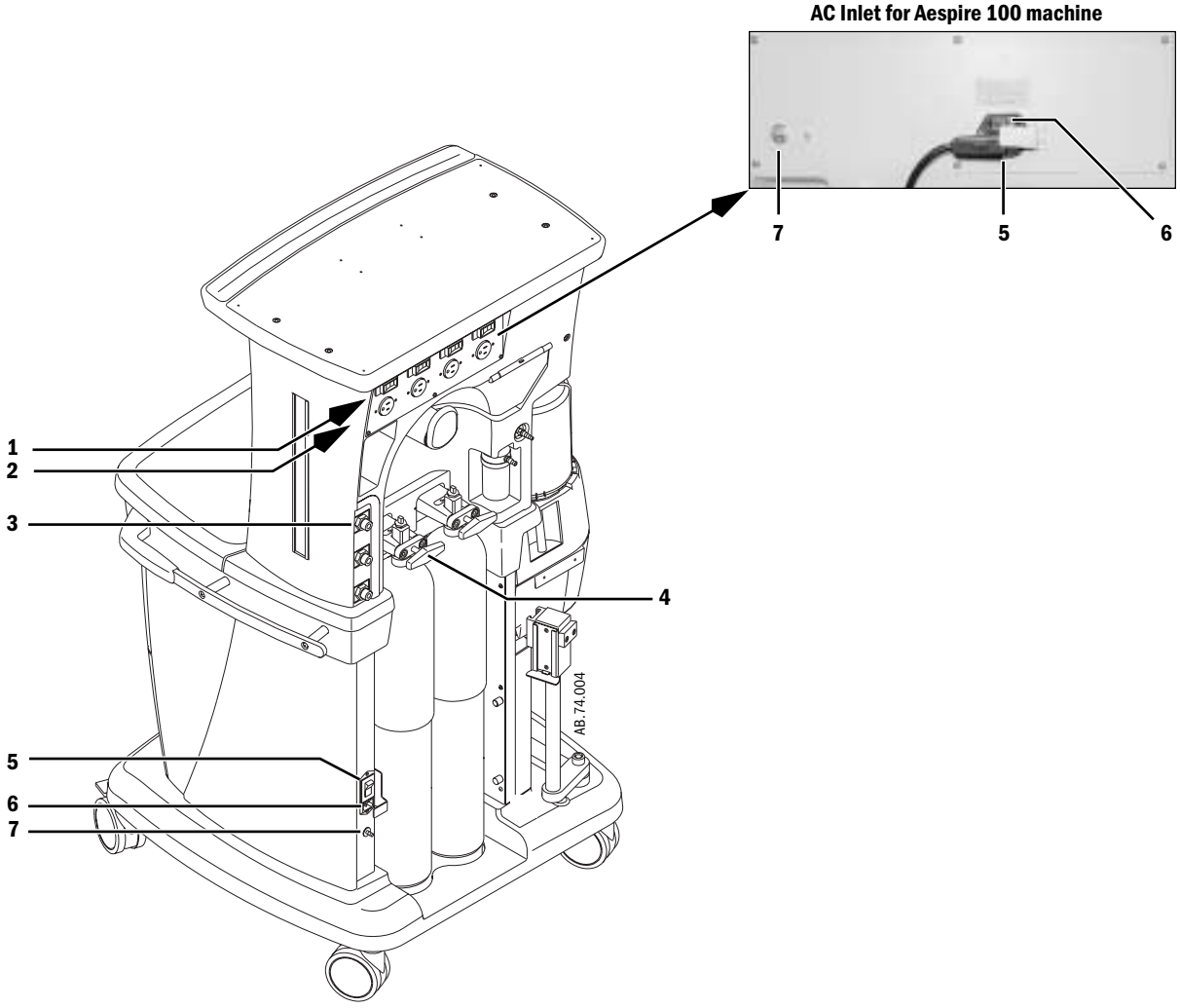
1. **Auxiliary common gas outlet (ACGO) switch**
2. **ACGO**
3. **Inspiratory check valve**
4. **Inspiratory flow sensor or flow port adapter**
5. **Canister (carbon dioxide absorbent)**
6. **Canister release**
7. **Expiratory flow sensor or flow port adapter**
8. **Leak test plug**
9. **Expiratory check valve**
10. **Breathing system release**
11. **Manual bag port**
12. **APL (adjustable pressure-limiting) valve**
13. **Bag/Vent switch**
14. **Bellows assembly**
15. **Pressure gauge (airway)**
16. **Sample gas return port**
17. **Scavenging flow indicator**
18. **RS-232 Serial port (not available in the Aespire 100 machine)**

Figure 1-1 • S/5 Aespire (front view - left side)



1. **ABS (Advanced Breathing System)**
2. **Flow controls**
3. **Ventilator Display/Control Module**
4. **Dovetail rails**
5. **Vaporizer**
6. **Pipeline pressure gauge(s) (upper row)**
7. **System switch**
8. **Cylinder pressure gauge(s) (lower row)**
9. **O_2 Flush**
10. **Auxiliary O_2 flowmeter**
11. **Suction regulator**

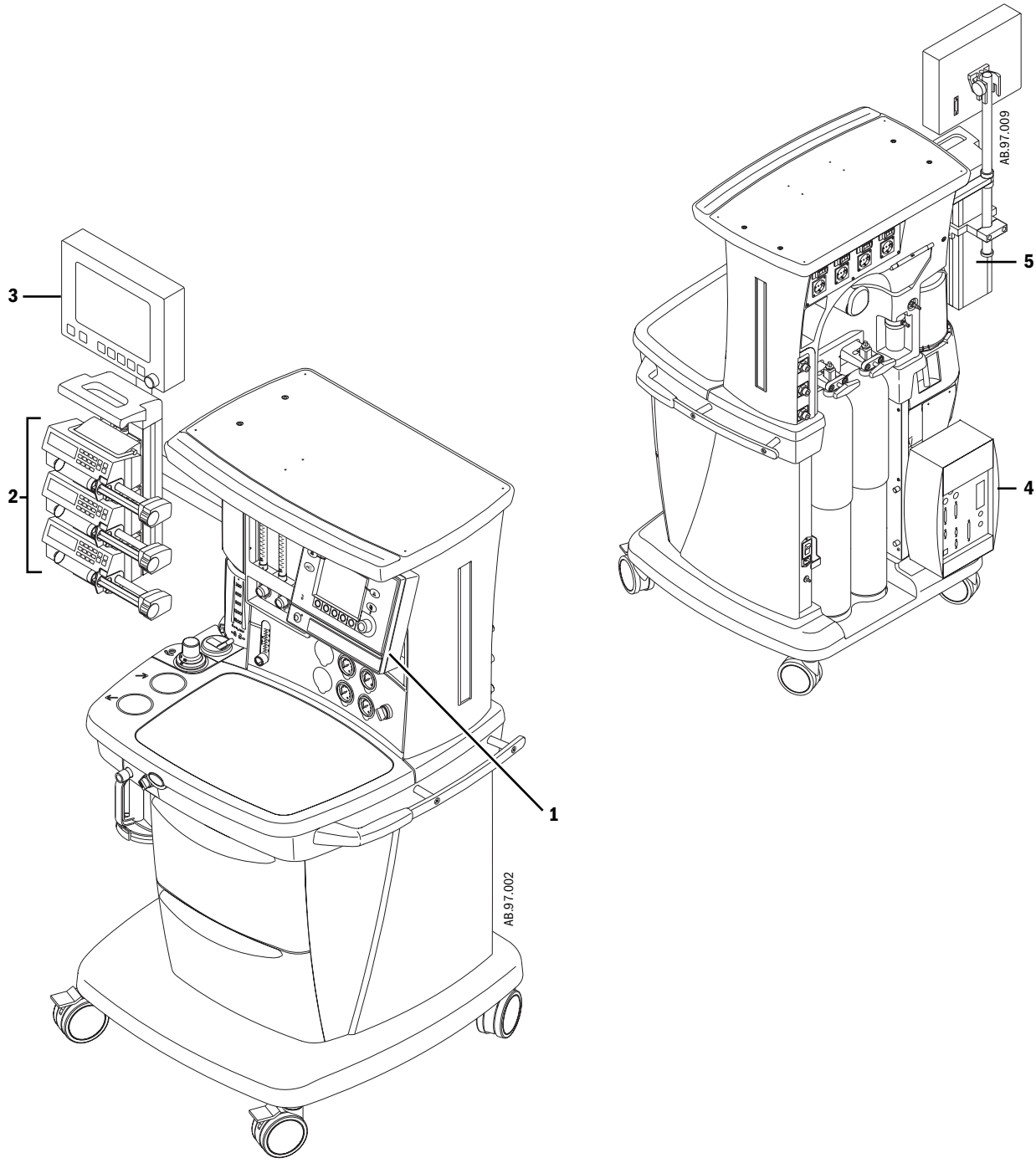
Figure 1-2 • S/5 Aespire (front view - right side)



1. **Circuit Breaker for Electrical Outlets***
2. **Electrical Outlets***
3. **Pipeline Connection(s)**
4. **Cylinder Supplies**
5. **System Circuit Breaker (AC Inlet fuses for Aespire 100 machine)**
6. **Mains Inlet**
7. **Equipotential Stud**

* Items marked with an asterisk (*) are not available in the Aespire 100 machine.

Figure 1-3 • S/5 Aespire (rear view)



1. **Ventilator/Monitoring display**
2. **Syringe pumps (3)**
3. **fm controller**
4. **fm computer**
5. **fm segment**

Figure 1-4 • S/5 ProTIVA with a typical B Braun fluid manager (fm) system

1.6 Symbols used in the manual or on the equipment

⚠ Warnings and ⚠ Cautions tell you about dangerous conditions that can occur if you do not follow all instructions in this manual.

Warnings tell about a condition that can cause injury to the operator or the patient.

Cautions tell about a condition that can cause damage to the equipment. Read and follow all warnings and cautions.

Other symbols replace words on the equipment or in Datex-Ohmeda manuals. No one device or manual uses all of the symbols. These symbols include:

On (power)

Off (power)

Standby

Standby or preparatory state for part of the equipment

“ON” only for part of the equipment

“OFF” only for part of the equipment

Direct current

Alternating current

Protective earth ground

Earth ground

Frame or chassis ground

Equipotential

Alarm silence button

Alarm silence touch key (Tec 6).

Type B equipment

Type BF equipment

Type CF equipment

Caution, ISO 7000-0434

Attention, refer to product instructions, IEC 601-1

Dangerous voltage

Electrical input

Electrical output

Pneumatic input

Pneumatic output

+	Plus, positive polarity
-	Minus, negative polarity
	Variability
	Variability in steps
	This way up
	Lamp, lighting, illumination
	Lock
	Unlock
	Close drain
	Open drain (remove liquid)
134°C	Autoclavable
	Not autoclavable
	Inspiratory flow
O_2%	O_2 sensor connection
REF	Stock Number

	Movement in one direction
	Movement in two directions
	Read top of float
	Vacuum inlet
	Suction bottle outlet
	Cylinder
	Isolation transformer
	Linkage system
	Risk of Explosion.
	Low pressure leak test
	Mechanical ventilation
	Bag position/ manual ventilation
	Expiratory flow
O_2+	O_2 Flush button
SN	Serial Number

Alarm silence touch key

Volume alarms On/Off touch key

End case touch key

Menu touch key

Circle breathing circuit module

Bain/Mapleson D breathing circuit module

The primary regulator is set to pressure less than 345 kPa (50 psi)

The primary regulator is set to pressure less than 414 kPa (60 psi)

Absorber on

CO_2 Bypass Option

Absorber off (CO_2 Bypass active)

Systems with this mark agree with the European Council Directive (93/42/EEC) for Medical Devices when they are used as specified in their Operation and Maintenance Manuals. The xxxx is the certification number of the Notified Body used by Datex-Ohmeda's Quality Systems.

CE European Union Representative

Notes

2 Theory of Operation

In this section

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2.1 Theory overview

This section describes:

- The flow of gas through the anesthesia machine.
- The flow of gas through the breathing system.
- Electrical signals between the anesthesia machine, including the breathing system, and the ventilator.

2.2 Gas flow through the anesthesia machine

2.2.1 Overview

Refer to Figure 2-1.

Gas supplies

Gas comes into the system through a pipeline (**2**) or cylinder (**4**) connection. All connections have indexed fittings, filters, and check valves (one-way valves). Gauges show the pipeline (**1**) and cylinder (**3**) pressures.

A primary regulator (**5**) decreases the cylinder pressures to approximately pipeline levels. A pressure relief valve (**6**) helps protect the system from high pressures.

To help prevent problems with the gas supplies:

- Install yoke plugs on all empty cylinder connections.
- When a pipeline supply is adequate, keep the cylinder valve closed.

O_2 flow

Pipeline or regulated cylinder pressure supplies O_2 directly to the ventilator (**7a** for O_2 drive gas) and the venturi suction (**21a** for O_2 drive gas) supply connection. An additional regulator (**13**) decreases the pressure for the flush valve (**14a**) and the auxiliary flowmeter (**25**).

The flush valve supplies high flows of O_2 to the fresh gas outlet (**26** or **27**) when you push the flush button. The flush pressure switch (**14b**) monitors activation of the flush valve.

When the system switch (**8**) is On, O_2 flows to the rest of the system.

A secondary regulator (**10**) supplies a constant O_2 pressure to the O_2 flow control valve (**11**). There is a minimum flow of 25 to 75 mL/min (for dual-tube flowmeters) or 175 to 225 mL/min (for single-tube flowmeters) through the O_2 flowmeter (**12**).

The O_2 pressure switch (**9**) monitors the O_2 supply pressure. If the pressure is too low, an alarm appears on the ventilator display.

Air and N_2O flow

Pipeline or regulated cylinder pressure supplies Air directly to the ventilator (**7b** for Air drive gas) and the venturi suction (**21b** for Air drive gas) supply connection.

When the system switch (**8**) is On, air flows to the rest of the system.

A secondary regulator (**18**) supplies the Air flow control valve (**19**). Because there is no balance regulator, air flow continues at the set rate during an O_2 supply failure.

A balance regulator (**15**) controls the N_2O supply pressure to the N_2O flow control valve(**16**). The O_2 secondary regulator pressure at a pilot port controls the output of the balance regulator. The N_2O output pressure drops with decreasing O_2 supply pressure and shuts off hypoxic gas flow before the O_2 supply pressure reaches zero.

A chain link system (Link-25) on the N_2O and O_2 flow controls (**16, 11**) helps keep the O_2 concentration higher than 21% (approximate value) at the common gas outlet.

Mixed gas

The mixed gas goes from the flowmeter outlet, through the vaporizer manifold and vaporizer (**23**) that is On, to the ACGO selector switch (**E**). A pressure relief valve (**24**) sets the maximum outlet pressure.

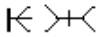
The ACGO selector switch directs the mixed gas to the selected circuit — to the breathing system (**26**) or to the ACGO (**27**).

Key to Numbered Components

1. Pipeline pressure gauge
2. Pipeline inlet
3. Cylinder pressure gauge
4. Cylinder inlet (maximum of 3 cylinders)
5. Primary regulator (cylinder pressure)
6. High-pressure relief valve (758 kPa / 110 psi)*
7. Supply connections for the ventilator
   a. O_2 drive gas
   b. Air drive gas
8. System switch
9. Switch for low O_2 supply pressure alarm (used with the ventilator)
10. O_2 secondary regulator (207 kPa / 30 psi)*
11. O_2 flow control valve
12. O_2 flow tube(s)
13. O_2 flush and auxiliary flowmeter regulator (241 kPa / 35 psi)*
14. O_2 Flush
    a. Flush valve
    b. Pressure switch (used with the ventilator)
15. N_2O balance regulator
16. N_2O flow control valve
17. N_2O flow tube(s)
18. Air secondary regulator (207 kPa / 30 psi)*
19. Air flow control valve
20. Air flow tube(s)
21. Supply connection for Venturi suction
    a. O_2 drive gas
    b. Air drive gas
22. Vaporizer port valve
23. Vaporizer
24. Low-pressure relief valve (38 kPa / 5.5 psi)*
25. Auxiliary flowmeter (optional)
26. To ABS
27. To ACGO
28. Test port (primary regulator)
29. Test port (secondary/balance regulator)

* Approximate values

Key to Symbols


Pneumatic Connection

Filter

Direction of Flow

Check Valve

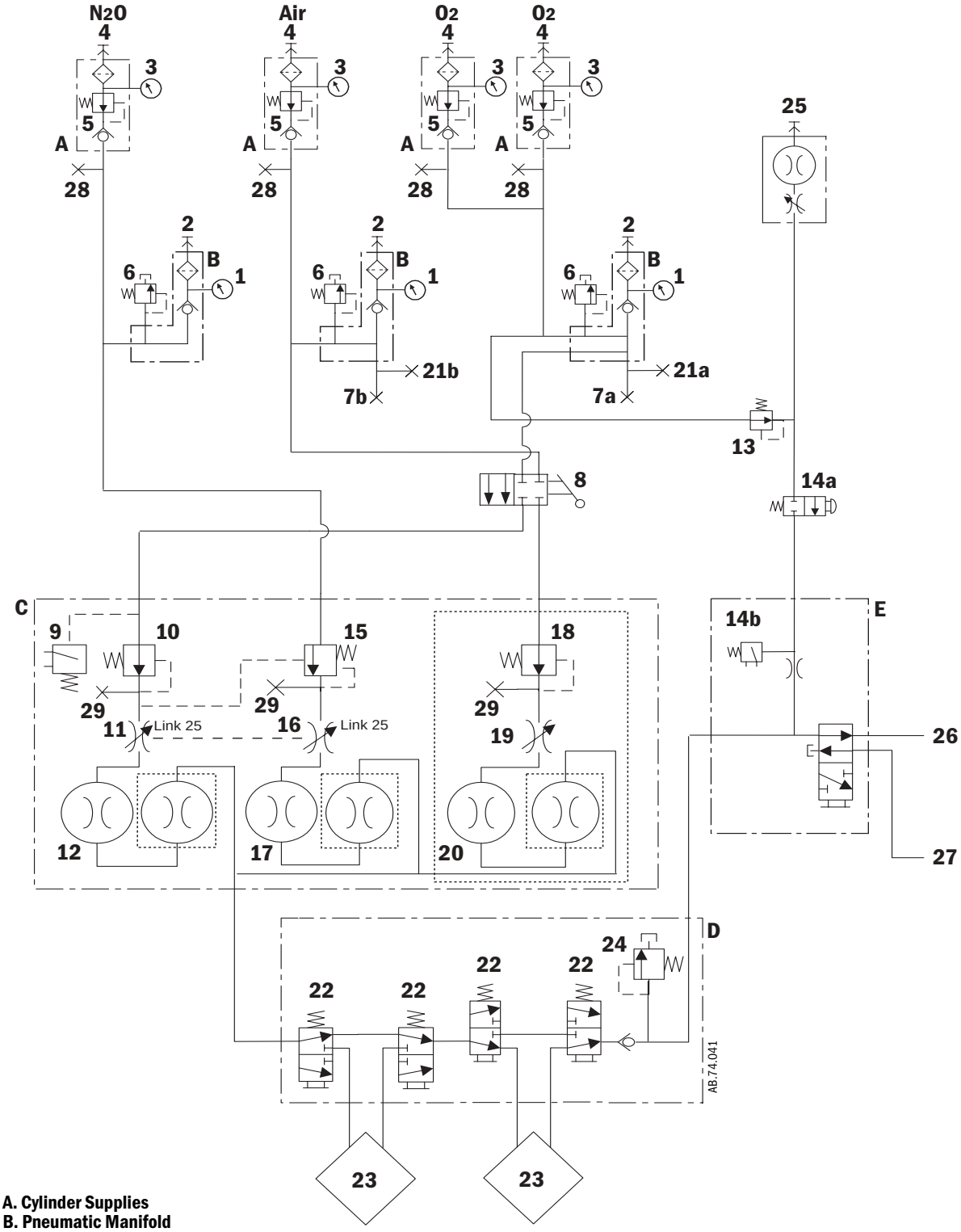


Figure 2-1 • Pneumatic circuit

2.2.2 Physical connections

Figure 2-2 shows the physical path that the gas takes.

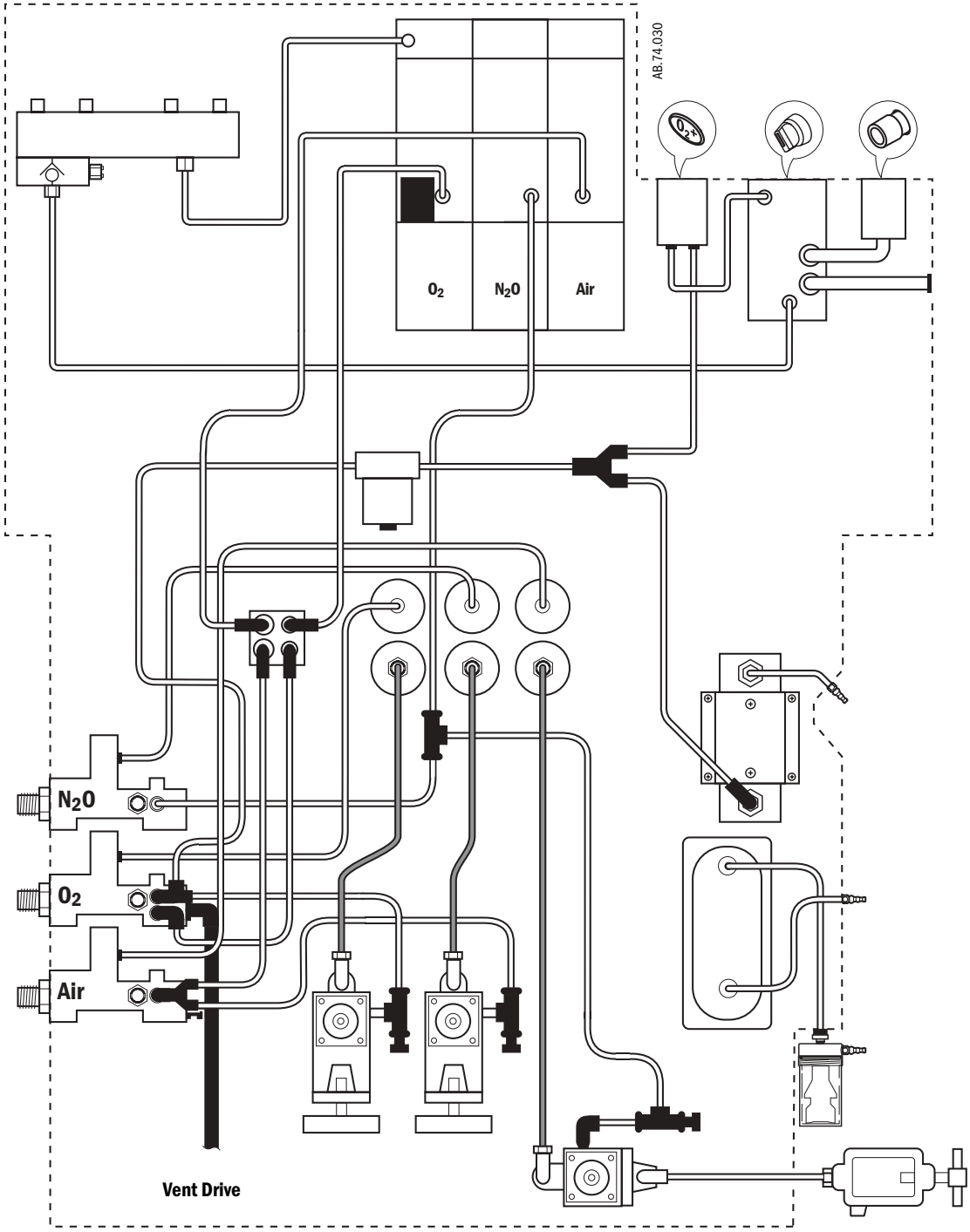


Figure 2-2 • Typical tubing connections - pictorial

2.2.3 Suction regulators

Pipeline vacuum

The suction regulator (shown in Figure 2-2) uses an external vacuum source.

Venturi Drive vacuum

The suction regulator (shown in Figure 2-3) uses an internal, venturi derived vacuum source.

Drive gas (internally plumbed **Air** or **O_2**) enters the Venturi Module (**VM**) at the drive port (**A**). As the drive gas passes through the venturi module, a vacuum is created at port **B**. The drive gas exits the venturi module at port **C** and is exhausted outside the machine through the muffler (**D**).

The control port (**E**) on the venturi module responds to pneumatic signals from the front panel switch on the Suction Control Module (**SCM**) to turn the venturi vacuum drive gas on or off. The check valve (**CV**) helps prevent pressurization of the suction circuitry if the exhaust is occluded or the venturi unit fails.

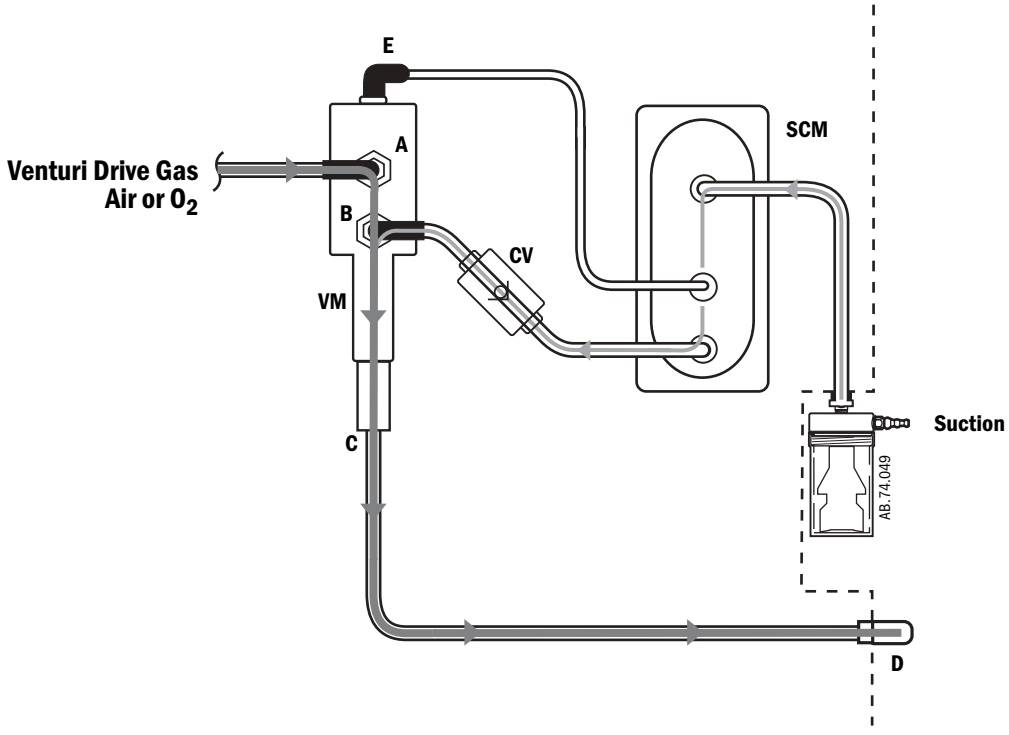


Figure 2-3 • Venturi suction

2.2.4 System switch

The system switch has two positions: On and Standby.

In the Standby position

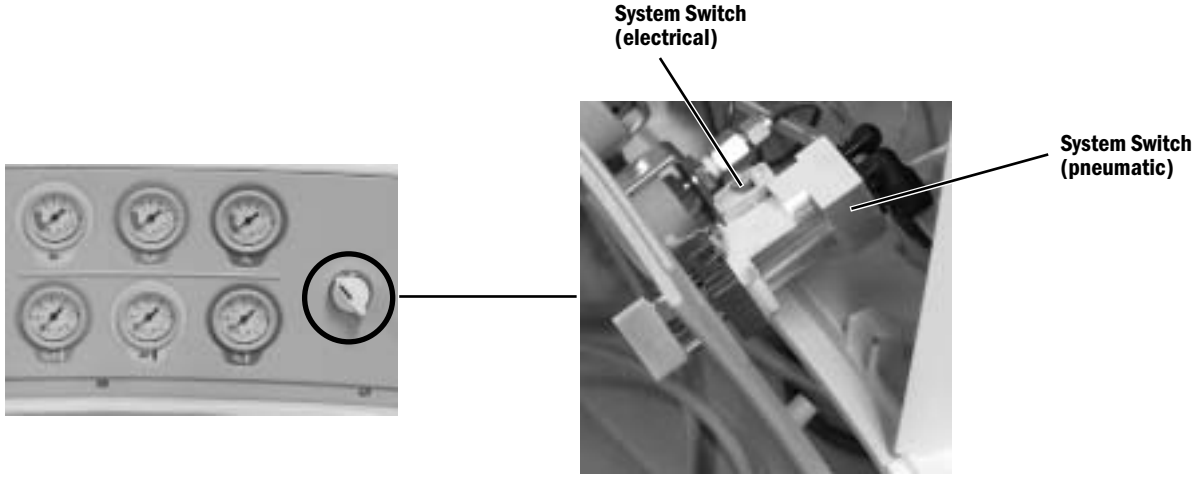
The switch:

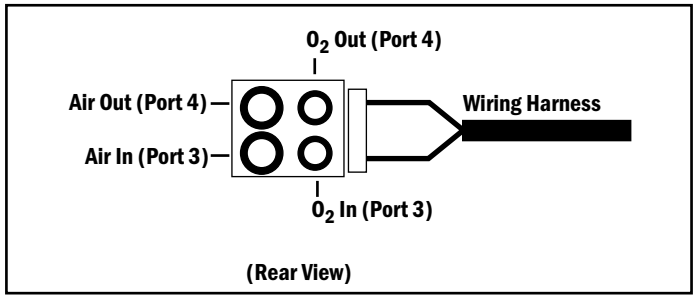
- Turns off the ventilator (electrical).
- Stops O_2 and Air to the flowhead (pneumatic).
- Without O_2 pressure, the N_2O balance regulator stops N_2O.

In the On position

The switch:

- Turns on the ventilator (electrical).
- Supplies O_2 and Air to the flowhead.
- With adequate O_2 pressure, the N_2O balance regulator supplies N_2O.



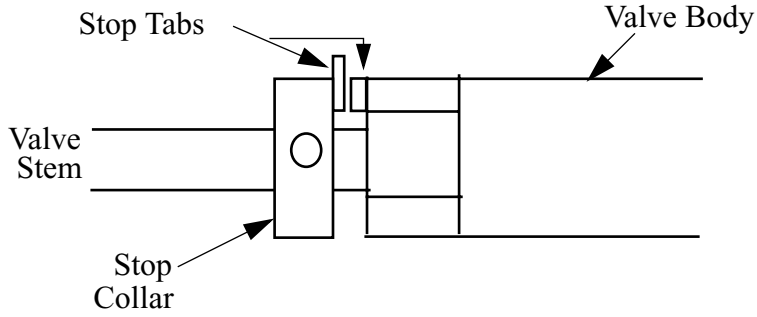


2.2.5 Flow control

Needle valves (one for each gas) adjust gas flows. Clockwise rotation decreases flow. Counterclockwise increases flow. Mechanical stops set minimum flows for all gases. The link system sets the maximum ratio of N_2O to O_2.

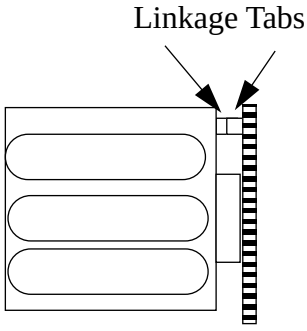
⚠ WARNING The Link 25 Proportioning System sets a minimum O_2 concentration in the fresh gas stream when only O_2 and N_2O are used. Use of an absorber or another gas can still cause a hypoxic mixture to be delivered to the patient, especially at low O_2 flow rates.

Minimum flows At minimum flow, two tabs prevent clockwise rotation of the valve stem. One tab is on the stop collar; the other is on the valve body.



Link system The chain link system helps assure an approximate minimum 1 to 3 ratio of flow between O_2 and N_2O. When engaged (minimum O_2 concentration), a tab on the O_2 knob is in contact with a tab on the O_2 sprocket so that the O_2 and N_2O knobs turn together:

- an increase in N_2O flow causes an increase in O_2 flow,
- a decrease in O_2 flow causes a decrease in N_2O flow.



O_2 Knob

Higher concentrations of O_2 are possible when the link system is not engaged: either by reducing the N_2O flow below the point of engagement or by increasing O_2 flow above the point of engagement.

When the N_2O flow is below the point of engagement, increasing the N_2O flow turns the O_2 sprocket without changing the O_2 flow. At the point of engagement, the tab on the O_2 sprocket makes contact with the tab on the O_2 knob. Once the linkage is engaged, turning the N_2O flow control counterclockwise (increase in N_2O flow) also turns the O_2 knob counterclockwise (increase in O_2 flow) to maintain a nominal 25% minimum O_2 concentration.

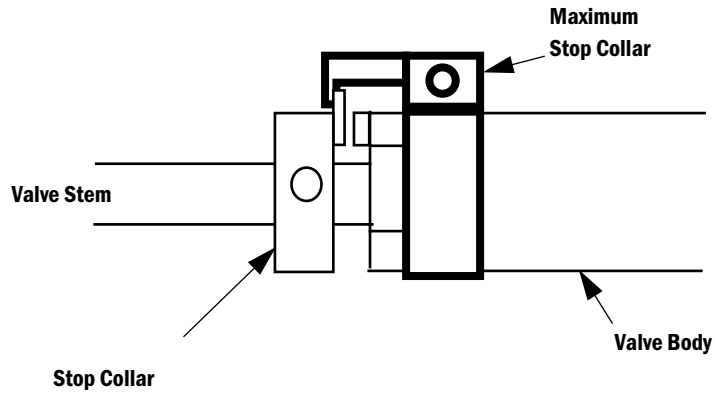
Decreasing the N_2O flow from the engagement point rotates the tab on the O_2 sprocket away from the tab on the O_2 knob. Increasing the O_2 flow rotates the knob tab away from the sprocket tab. Either action increases the O_2 concentration above 21%. Sufficiently decreasing O_2 flow or increasing the N_2O flow brings the two tabs back into contact and engages the linkage.

The kick-in point is defined as the N_2O flow at which the N_2O valve becomes engaged with the O_2 valve flowing at 200 mL/min. This engagement point is an arbitrary benchmark that assists in calibrating the proportioning system. The position of the kick-in is set in the factory. During field calibration, you set the O_2 flow to 200 mL/min and the N_2O flow to the kick-in flow (usually in the range of 400 to 700 mL/min) and then install the sprockets with the O_2 knob/sprocket engaged.

Maximum flows

All gas flows in Canada require maximum flow stops. A maximum stop collar on the body of the needle valve and a stop collar on the stem of the needle valve set the maximum flow.

At maximum flow, a tab on the stop collar hits the tab on the maximum stop collar and prevents you from turning the knob further counterclockwise. As you decrease the flow, the valve stem moves toward the needle valve assembly and clears the tab.



2.3 Flow through the breathing system

2.3.1 Overview of flow paths

This section looks at three types of flow paths.

- **Ventilation paths:** How gas flows from the drive source (bag or bellows) to and from the patient.
- **Fresh gas paths:** Fresh gas can flow from the machine interface directly to the patient through the inspiratory check valve, or through the absorber into the expiratory flow, or directly to an external circuit through the optional auxiliary common gas outlet.
- **Scavenged gas paths:** APL or Pop-off.

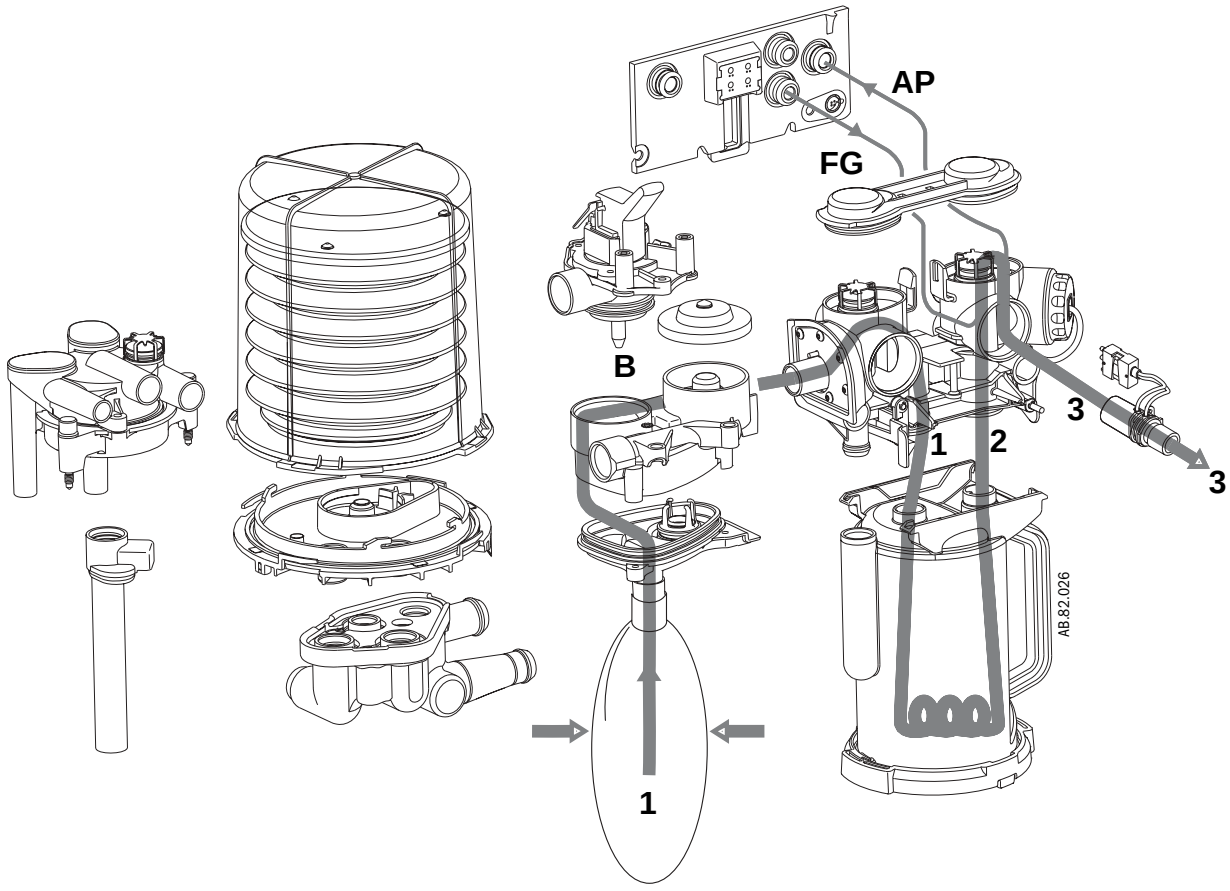
2.3.2 Manual ventilation

Manual inspiration
(Figure 2-4)

The Bag/Vent switch closes the ventilator path (**B**).

Gas flows from the bag (**1**), through the absorber (**2**), into the breathing circuit module, and through a unidirectional valve (inspiratory check valve) to the patient (**3**).

During inspiration, fresh gas (**FG**) flows from the machine into the inspiratory limb, upstream of the inspiratory check valve.



B Bag/Vent switch to Bag
FG Fresh Gas
AP Airway Pressure
1 Flow to absorber
2 Flow from absorber
3 Inspiratory flow

Figure 2-4 • Gas flow during manual inspiration

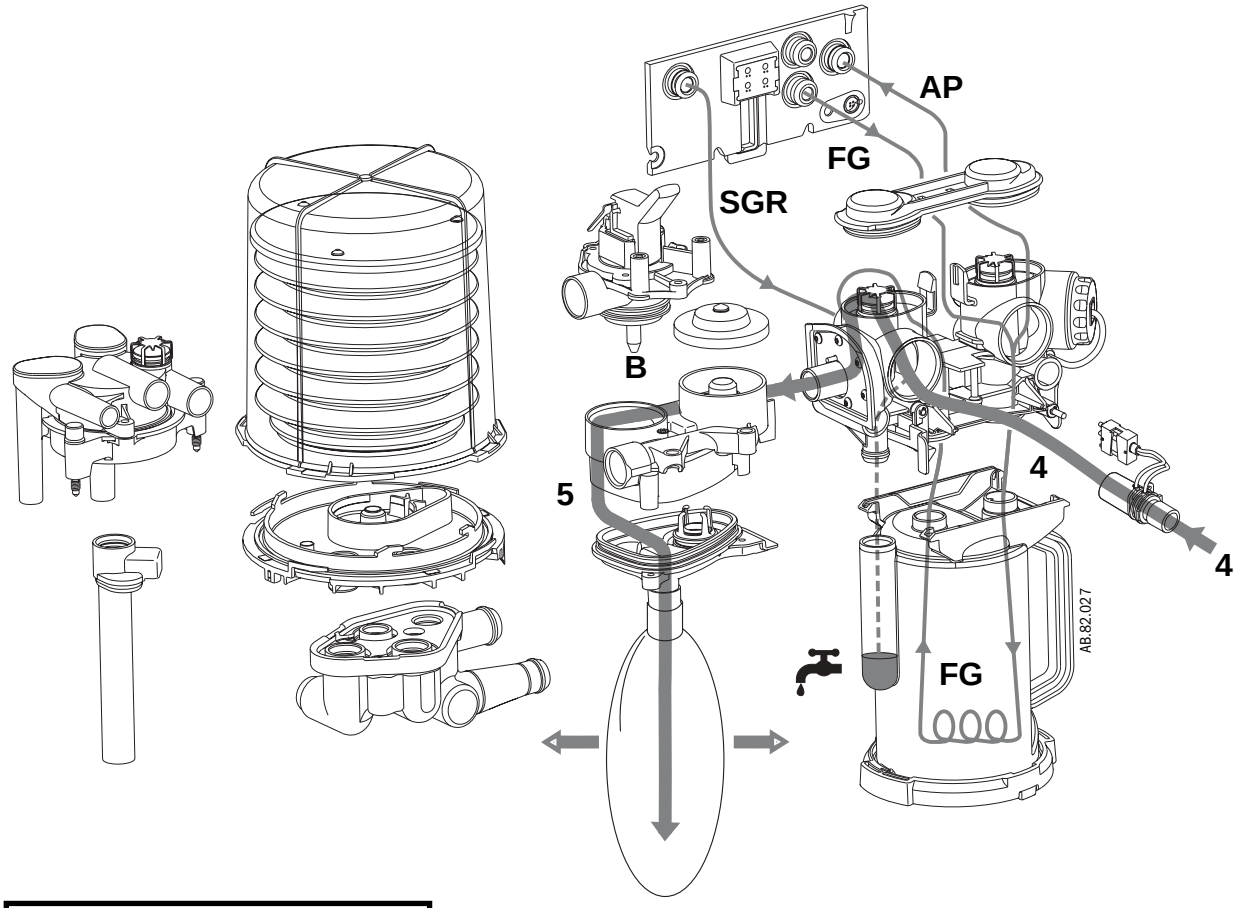
Manual expiration
(Figure 2-5)

The Bag/Vent switch keeps the ventilator path closed (**B**).

Gas flows from the patient (**4**), through a unidirectional valve (expiratory check valve), and into the bag (**5**).

During exhalation, fresh gas flows backwards through the absorber (**FG**) into the expiratory limb, downstream of the expiratory check valve.

For machines that are plumbed to return sample gas to the breathing system, the returned gas (**SGR**) enters the breathing system after the expiratory check valve (Refer to section 4.13).



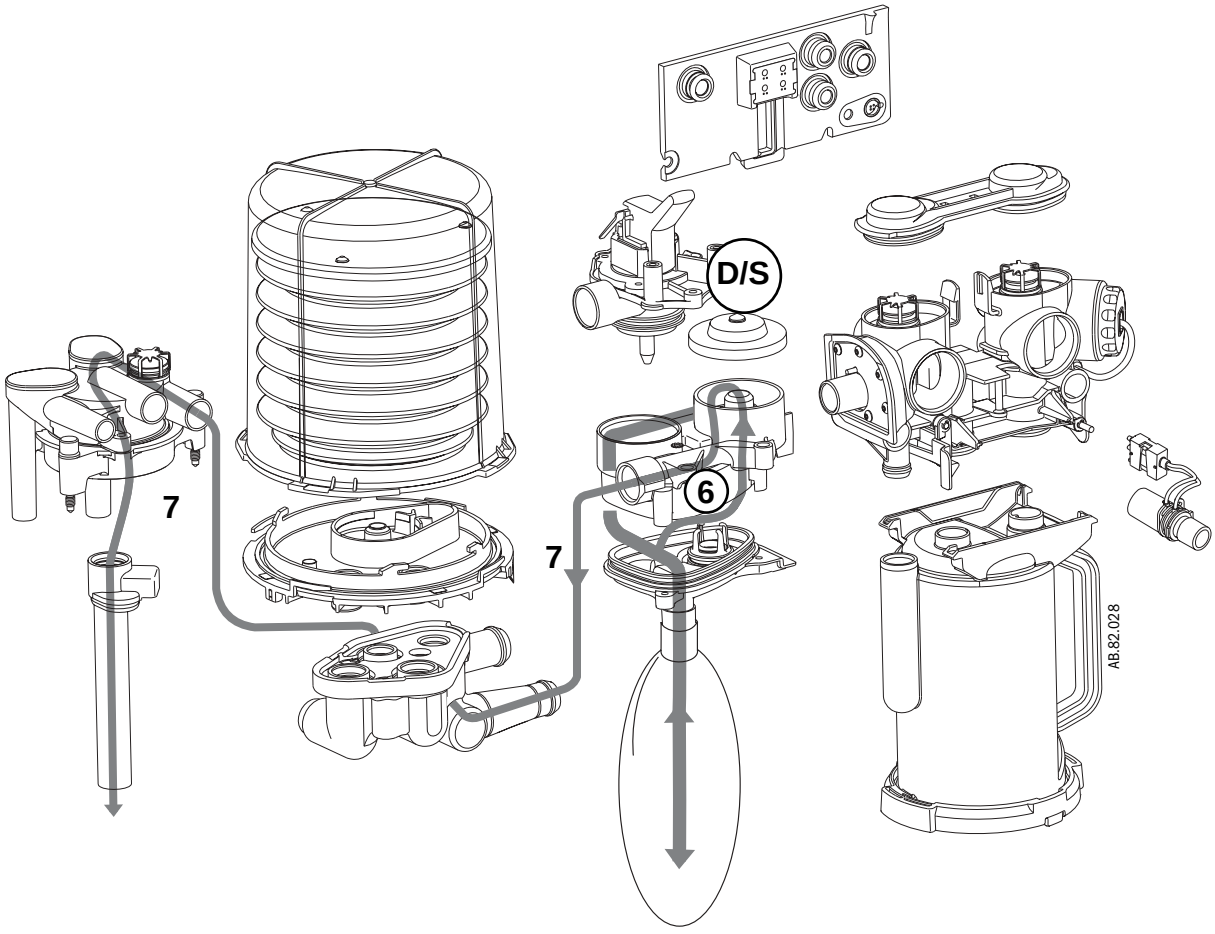
AP Airway Pressure
B Bag/Vent switch to Bag
FG Fresh Gas
SGR Sample Gas Return
4 Expiratory flow
5 Flow to bag

Figure 2-5 • Flow during manual expiration

APL Valve
(Figure 2-6)

The APL valve sets a pressure limit for manual ventilation.

As you turn the APL knob, it puts more or less force on the APL disc and seat (**D/S**). If the circuit pressure is too high (**6**), the disc and seat inside the diaphragm opens and vents gas to the scavenging system (**7**).



D/S APL disc and seat
6 APL flow
7 To scavenging

Figure 2-6 • Flow through the APL Valve

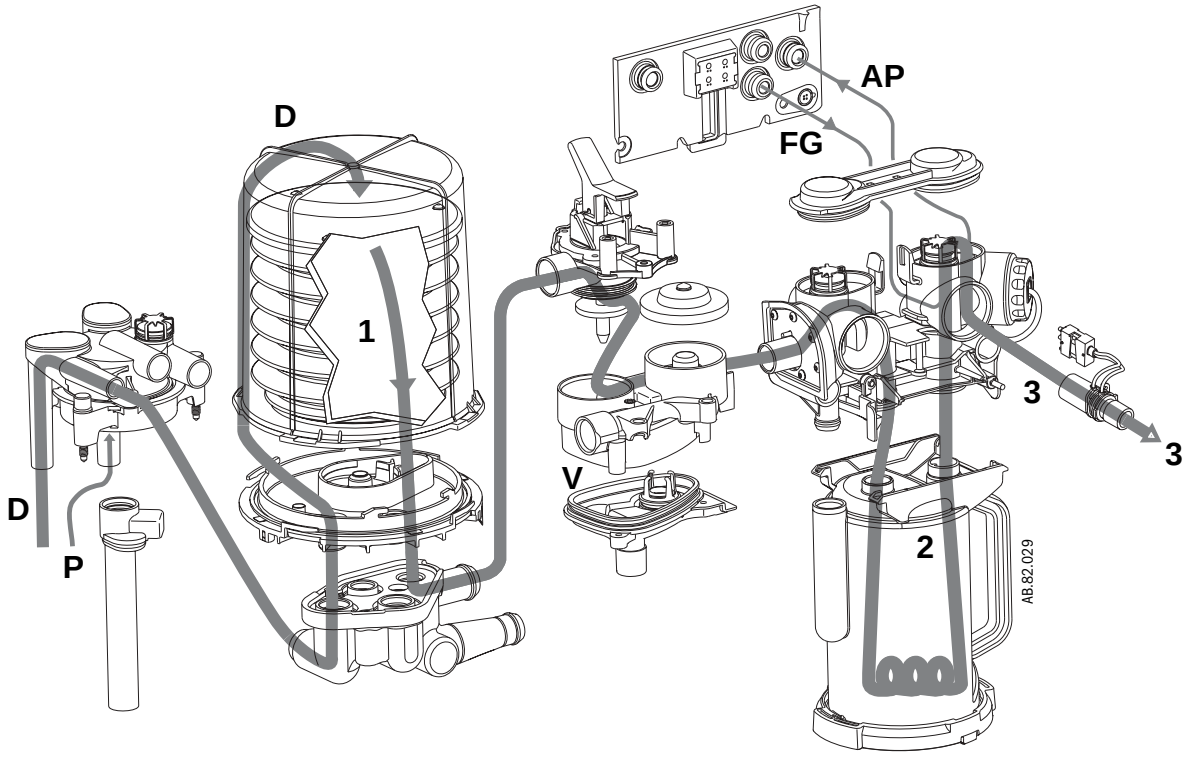
2.3.3 Mechanical ventilation

Mechanical inspiration (Figure 2-7)

The Bag/Vent switch closes the manual path (**V**). Pilot pressure (**P**) closes the exhalation valve.

Drive gas (**D**) pushes down on the bellows. Gas flows from the bellows (**1**), through the absorber (**2**), and through a unidirectional valve (inspiratory check valve) to the patient (**3**).

During inspiration, fresh gas flows into the inspiratory limb, upstream of the inspiratory check valve.



V Bag/Vent switch to Vent
P Pilot pressure
D Drive gas
FG Fresh Gas
AP Airway Pressure
1 Flow to absorber
2 Flow from absorber
3 Inspiratory flow

Figure 2-7 • Mechanical inspiration

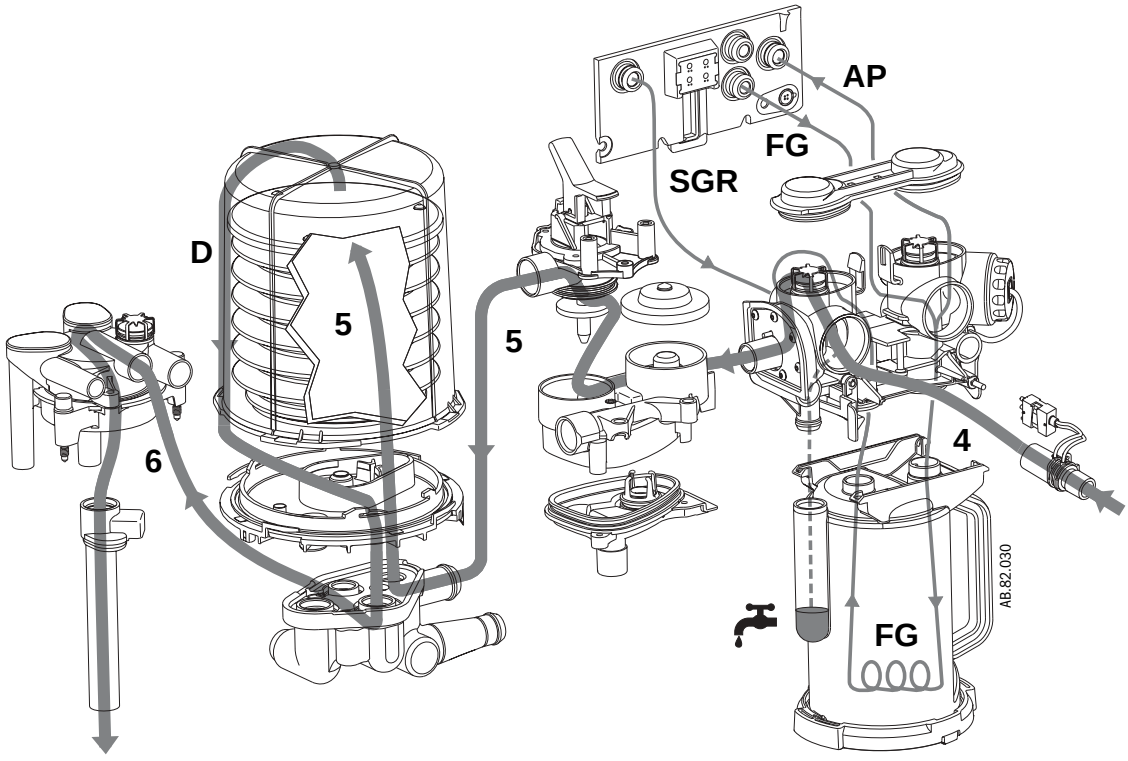
Mechanical expiration
(Figure 2-8)

Drive-gas flow stops and the exhalation valve opens. Exhaled gas flows from the patient (**4**), through a unidirectional valve (expiratory check valve) and into the bellows (**5**). Residual drive gas (**D**) flows out of the bellows to the scavenging system (**6**).

If PEEP is selected, static pressure on the pilot port of the exhalation valve sets the PEEP level.

During exhalation, fresh gas flows backwards through the absorber (**FG**) into the expiratory limb, downstream of the expiratory check valve.

For machines that are plumbed to return sample gas to the breathing system, the returned gas (**SGR**) enters the breathing system after the expiratory check valve (Refer to section 4.13).

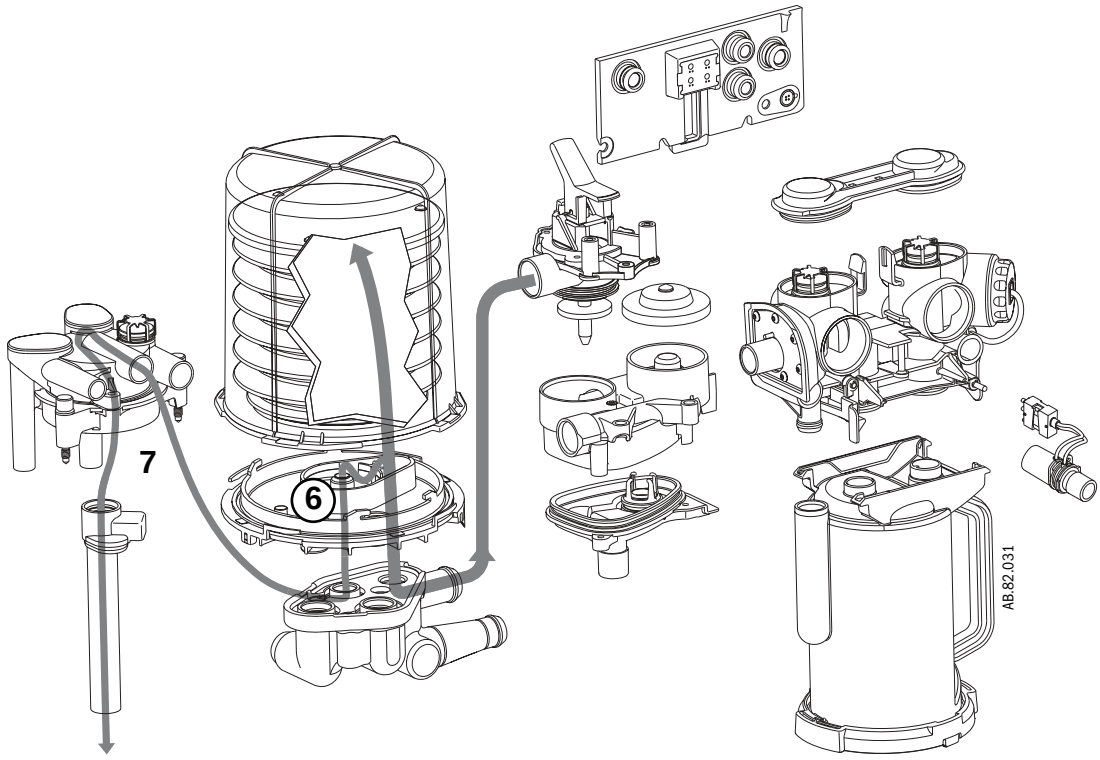


AP Airway Pressure
D Drive gas
FG Fresh Gas
SGR Sample Gas Return
4 Expiratory flow
5 Flow to bellows
6 To scavenging

Figure 2-8 • Flow through the APL Valve

Pop-off valve(Figure 2-9) The pop-off valve limits the pressure inside the bellows to 2.5 cm H_2O above the drive gas pressure. This normally occurs when the bellows reaches the top of the housing at the end of exhalation.

Excess gas (**7**) vents to the scavenging system (**6**) through the pop-off valve and the exhalation valve.



6 Pop-off flow
7 To scavenging

Figure 2-9 • Flow through the pop-off valve

2.3.4 Fresh gas and O_2 flush flow

To ABS breathing system (Figure 2-10)

Fresh gas (**1**) flows from the vaporizer manifold outlet to the ACGO Selector Switch.

With the ACGO Selector Switch in the ABS position, fresh gas flow is channeled to the breathing system.

The output of the O_2 Flush regulator (**2**) is channeled to the O_2 Flush valve. When activated, O_2 flush flow joins the fresh gas flow in the ACGO Selector Switch.

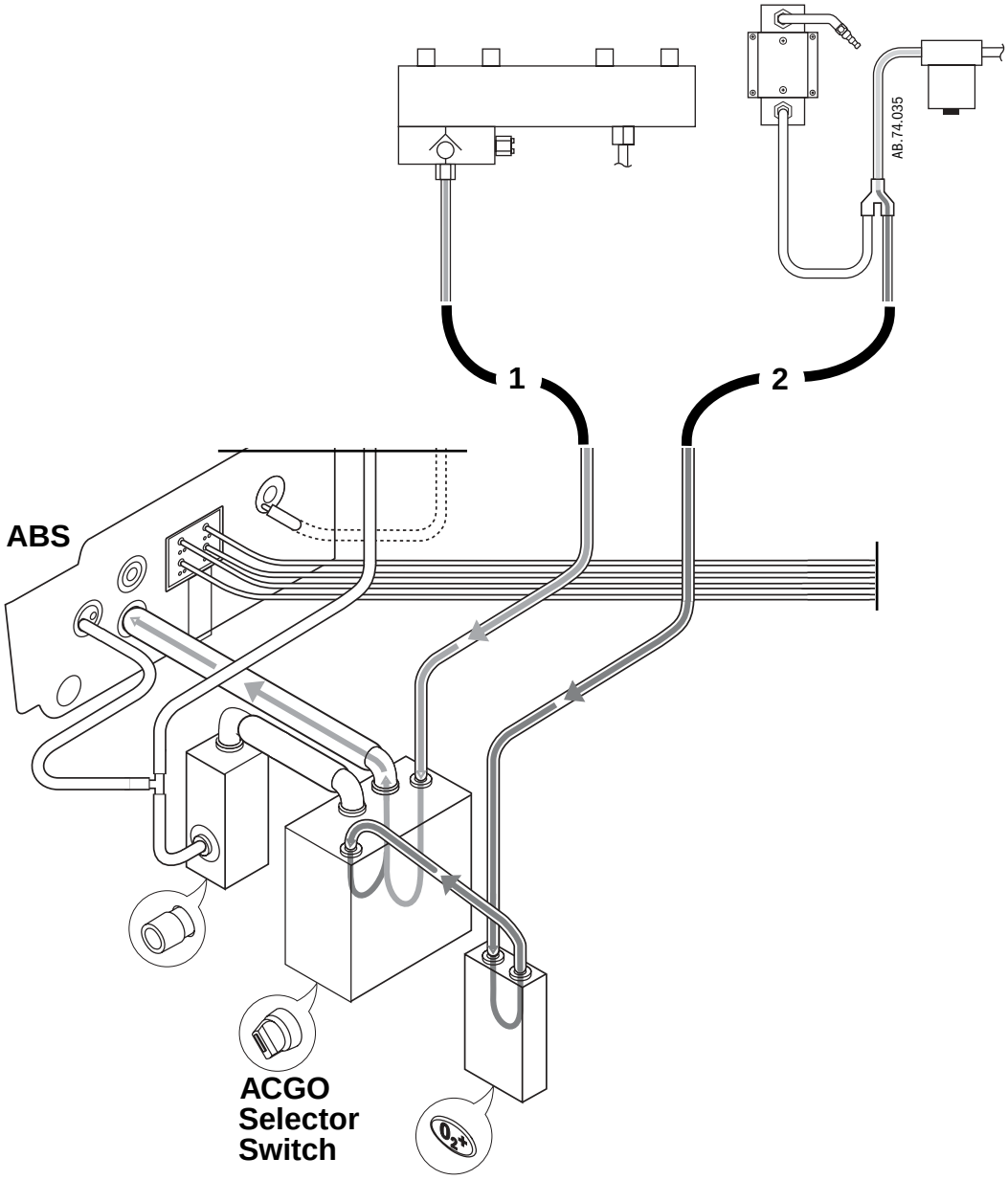


Figure 2-10 • Fresh gas and O_2 flush flow (to ABS)

Auxiliary Common Gas Outlet(Figure 2-11)

Fresh gas (**1**) flows from the vaporizer manifold outlet to the ACGO Selector Switch.

With the ACGO Selector Switch in the ACGO position, fresh gas flow is channeled to the ACGO outlet.

At the ACGO outlet, a small sample is diverted to the O_2 Sensor in the ABS for O_2 monitoring.

The output of the O_2 Flush regulator (**2**) is channeled to the O_2 Flush valve. When activated, O_2 flush flow joins the fresh gas flow in the ACGO Selector Switch.

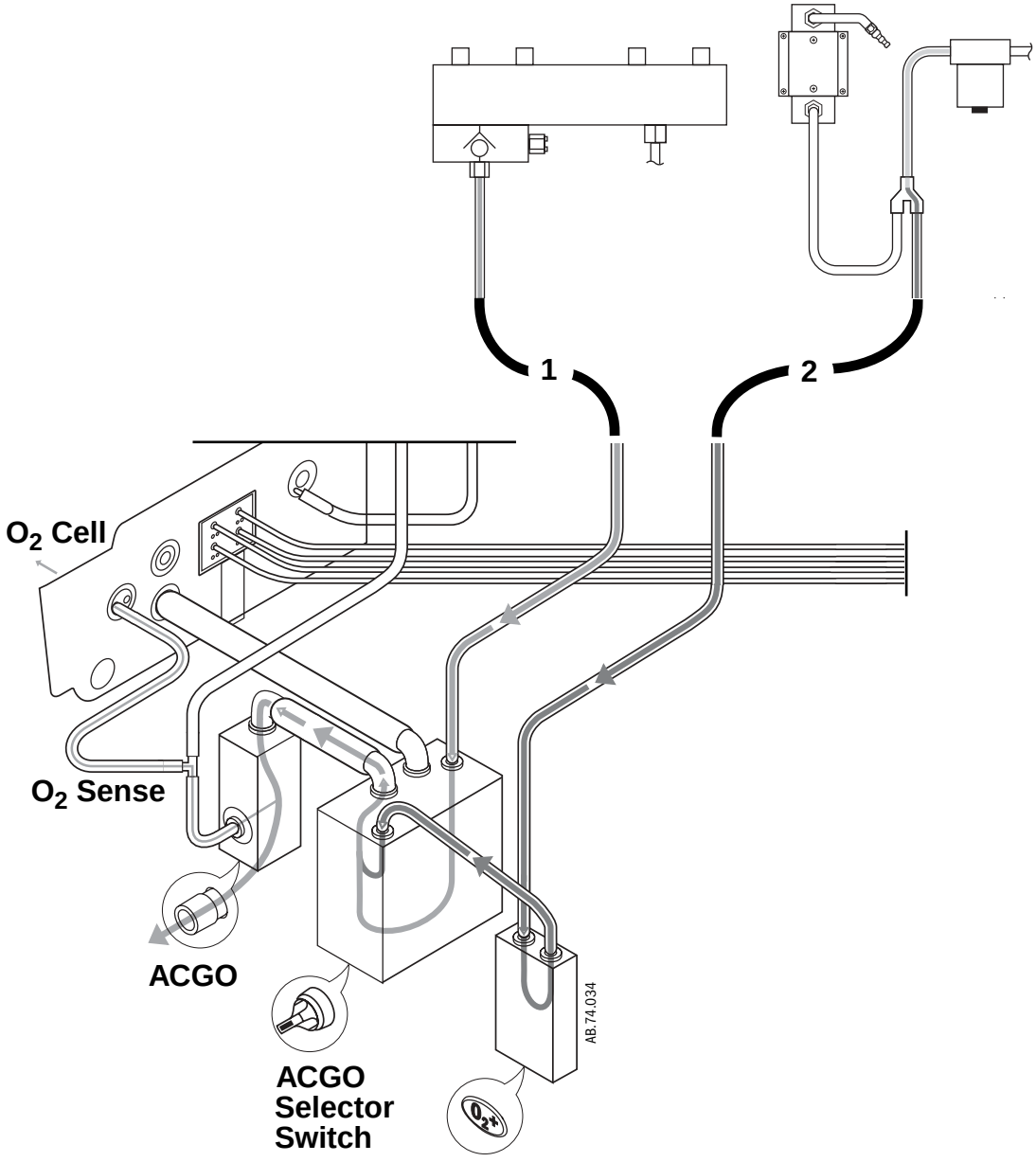


Figure 2-11 • Fresh gas and O_2 flush flow (to ACGO)

Notes

3 Checkout Procedure

In this section

3.1 Inspect the system 3-2

3.2 Pipeline and cylinder tests 3-3

3.3 Flow control, pressure relief, O_2 supply alarm, and flush flow tests 3-4

- 3.3.1 With O_2 monitoring 3-4
- 3.3.2 Without O_2 monitoring 3-6
- 3.3.3 Pressure relief tests 3-8
- 3.3.4 O_2 supply alarm test 3-8
- 3.3.5 Flush Flow Test 3-8

3.4 Vaporizer back pressure test 3-10

3.5 Low-pressure leak test 3-11

- 3.5.1 Negative low-pressure leak test 3-11
- 3.5.2 ISO or BSI standard low-pressure leak test 3-12

3.6 Alarm tests 3-14

3.7 Breathing system tests 3-16

3.8 Auxiliary O_2 flowmeter tests 3-18

3.9 Integrated Suction Regulator tests 3-18

3.10 Power failure test 3-19

3.11 Electrical safety tests 3-19

⚠ WARNINGS After any repair or service of the Aespire system, complete all tests in this section.

Before you do the tests in this section:

- Complete all necessary calibrations and subassembly tests. Refer to the individual procedures for a list of necessary calibrations.
- Completely reassemble the system.

If a test failure occurs, make appropriate repairs and test for correct operation.

3.1 Inspect the system

Make sure that:

- The equipment is not damaged.
- All components are correctly attached.
- Pipeline gas supplies are connected and the pressures are correct.
- A supply of reserve O_2 is provided and connected to the machine.
- Cylinder valves are closed on models with cylinder supplies.

⚠ CAUTION The upper shelf weight limit is 34 kg (75 lb).

⚠ WARNING Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

- Models with cylinder supplies have a cylinder wrench attached to the system.
- Make sure the casters are not loose and the brake is set and prevents movement.

3.2 Pipeline and cylinder tests

⚠ CAUTION To prevent damage:

- Open the cylinder valves slowly.
- Do not force the flow controls.

If your system does not use cylinder supplies, do not do steps 2 and 3.

1. Disconnect the pipeline supplies and close all cylinder valves (if equipped). If the pipeline and the cylinder pressure gauges are not at zero, bleed all gasses from the system.
   a. Connect an O_2 supply.
   b. Set the system switch to On.
   c. Set the flow controls to mid range.
   d. Make sure that all gauges but O_2 are at zero.
   e. Disconnect the O_2 supply.
   f. Make sure that the O_2 gauge goes to zero. As pressure decreases, alarms for low O_2 supply pressure should occur.
2. Make sure that the cylinders are full:
   a. Open each cylinder valve.
   b. Make sure that each cylinder has sufficient pressure. If not, close the applicable cylinder valve and install a full cylinder.
3. Test one cylinder at a time for high pressure leaks:
   a. Set the system switch to Standby, which stops the O_2 flow.
   b. If equipped, turn the auxiliary O_2 flow control fully clockwise (no flow).
   c. If equipped, turn off venturi derived suction.
   d. Open the cylinder.
   e. Record the cylinder pressure.
   f. Close the cylinder valve.
   g. Record the cylinder pressure after one minute. If the pressure decreases more than indicated below, there is a leak.
      5000 kPa (725 psig) for ventilator drive gas.
      690 kPa (100 psig) for non ventilator drive gas.
      Install a new cylinder gasket and do this step again.
   h. Repeat step 3 for all cylinders.

⚠ WARNING Do not leave gas cylinder valves open if the pipeline supply is in use. Cylinder supplies could be depleted, leaving an insufficient reserve supply in case of pipeline failure.

4. Connect the pipeline supplies one at a time and ensure that the corresponding gauge indicates pipeline pressure.

3.3 Flow control, pressure relief, O_2 supply alarm, and flush flow tests

If the system includes O_2 monitoring, complete the flow control tests in Section 3.3.1, "With O_2 monitoring".

If the system does not include O_2 monitoring, complete the flow control tests in Section 3.3.2, "Without O_2 monitoring".

3.3.1 With O_2 monitoring

⚠ **WARNING** Nitrous oxide (N_2O) flows through the system during this test. Use a safe and approved procedure to collect and remove it.

1. Set up the gas scavenging system.
   a. Connect the AGSS to a gas scavenging system.
   b. Attach a patient circuit and plug the patient port.
   c. Attach a bag to the bag port (or plug the bag port).
   d. Set the Bag/Vent switch to Bag.
   e. Adjust the APL valve to minimum.
2. Connect the pipeline supplies or slowly open the cylinder valves.
3. Turn all flow controls fully clockwise (minimum flow).
4. Set the ACGO selector switch to ABS.
5. Turn on the system.
6. Confirm that the O_2 sensor measures 21% in room air and 100% in pure O_2. If not, calibrate the O_2 sensor.
7. Make sure that:
   - For a dual-tube O_2 flowmeter, the O_2 flowtube shows 0.025 to 0.075 L/min.
   - For a single-tube O_2 flowmeter, the O_2 flowtube shows 0.175 to 0.225 L/min.
   - The other flowtubes show no gas flow.
8. Set the flow controls to mid range of each flowtube and make sure that the flowtube floats rotate and move smoothly.

Note If the system does not include N_2O, skip steps 9 and 10.

9. Check the Link proportioning system concentration (increasing N_2O flow). Observe the following precautions:
   a. Start with all valves at the minimum setting.
   b. Adjust only the N_2O flow control.
   c. Increase the N_2O flow as specified in the following table and make sure the O_2 concentration is in range.

Note: Allow the O_2 monitor to stabilize. At the lower flows, the O_2 monitor may take up to 90 seconds to stabilize.

d. If you overshoot a setting, turn the O_2 flow control clockwise until the N_2O flow decreases to the previous setting before continuing the test.

Set the N_2O flow (L/min)	Measured O_2
0.15 (dual flowtubes only)	21% minimum
0.5 (dual flowtubes only)	21% minimum
0.8	21% to 30%
1.0	21% to 30%
2.0	21% to 30%
6.0	21% to 30%
9.0	21% to 30%

10. Check the proportioning system concentration (decreasing O_2 flow). Observe the following precautions:

a. Start with N_2O valve at the maximum setting.

b. Adjust only the O_2 flow control.

c. Decrease the O_2 flow as specified in the table and make sure the O_2 concentration is in the allowed range.

Note: Allow the O_2 monitor to stabilize. At the lower flows, the O_2 monitor may take up to 90 seconds to stabilize.

d. If you overshoot a setting, turn the N_2O flow control counterclockwise until the O_2 flow increases to the previous setting before continuing the test.

Set the O_2 flow (L/min)	Measured O_2
3.0	21% to 30%
2.0	21% to 30%
1.0	21% to 30%
0.3	21% to 30%

11. Check the linearity of the Air flow control.

- Turn the N_2O flow control fully clockwise to minimum stop.

Set the O_2 flow (L/min)	Set the Air flow (L/min)	O_2 monitor range
4.0	3.0	61% to 71%
3.5	6.0	45% to 55%
1.5	8.0	28% to 38%

3.3.2 Without O_2 monitoring

⚠ WARNING The following procedure will test for any significant malfunction of the Link system but it will not confirm proper calibration. Periodic calibration procedures using an accurate and properly calibrated O_2 monitor must be performed as recommended in the User's Reference Manual, Part 2, section 3 User Maintenance.

⚠ Nitrous oxide (N_2O) flows through the system during this test. Use a safe and approved procedure to collect and remove it.

1. Set up the gas scavenging system.
   a. Connect the AGSS to a gas scavenging system.
   b. Attach a patient circuit and plug the patient port.
   c. Attach a bag to the bag port (or plug the bag port).
   d. Set the Bag/Vent switch to Bag.
   e. Adjust the APL valve to minimum.
2. Connect the pipeline supplies or slowly open the cylinder valves.
3. Turn all flow controls fully clockwise (minimum flow).
4. Set the ACGO selector switch to ABS.
5. Turn on the system.
6. Make sure that:
   - For a dual-tube O_2 flowmeter, the O_2 flowtube shows 0.025 to 0.075 L/min.
   - For a single-tube O_2 flowmeter, the O_2 flowtube shows 0.175 to 0.225 L/min.
   - The other flowtubes show no gas flow.
7. Set the flow controls to mid range of each flowtube and make sure that the flowtube floats rotate and move smoothly.

Note If the system does not include N_2O, skip steps 8 and 9.

8. Check the Link proportioning system (increasing N_2O flow). Observe the following precautions:
   a. Start with all valves at the minimum setting.
   b. Adjust only the N_2O flow control.
   c. Increase the N_2O flow as specified in the following table and make sure the O_2 flow is as specified.

d. If you overshoot a setting, turn the O_2 flow control clockwise until the N_2O flow decreases to the previous setting before continuing the test.

Set the N_2O flow control to (L/min)	The O_2 flow must be greater than (L/min):
0.8	0.2
2	0.5
4	1.0
10	2.5

9. Check the Link proportioning system (decreasing O_2 flow). Observe the following precautions:

   a. Set the N_2O flow to 9.0 L/min.

   b. Set the O_2 flow to 3 L/min or higher.

   c. While reducing the O_2 flow, set the N_2O flow to the rates shown in the table. The O_2 flow must be greater than the minimum limits.

   d. If you overshoot a setting, turn the N_2O flow control counterclockwise until the N_2O flow increases to the previous setting before continuing the test.

Set the N_2O flow (using the O_2 flow control) to (L/min)	The O_2 flow must be greater than (L/min)
8.0	2.0
4.0	1.0
0.8	0.2

3.3.3 Pressure relief tests

To check the pressure relief valve (vaporizer manifold outlet).

1. Turn all flow controls fully clockwise (minimum flow).
2. Set the ACGO selector switch to ACGO.
3. Connect a gauge or a digital manometer to the ACGO outlet using the positive pressure leak test adapter.
4. Adjust the O_2 flow to 0.5 L/min.
5. Verify that the test device reading stabilizes within the following range: **31–60 kPa**, **230–450 mm Hg**, **4.5–8.5 psi**.
6. Remove the test device and the adapter.

Test Adapter

3.3.4 O_2 supply alarm test

1. Set all flow controls to 3 L/min.
2. Stop the O_2 supply. (Disconnect the pipeline supply or close the cylinder valve.)
3. Make sure that:
   a. The low O_2 supply alarm occurs.
   b. The N_2O (if equipped) and O_2 flows stop. The O_2 flow stops last.
   c. Air (if equipped) flow continues.
   d. Gas supply alarms occur on the ventilator if the ventilator uses O_2 as the drive gas.
4. Turn all of the flow controls fully clockwise (minimum flow).
5. Reconnect the pipeline supplies.

3.3.5 Flush Flow Test

With Ventilator

1. Set the Bag/Vent switch to Vent.
2. Set the system switch to Standby.
3. Attach a patient circuit and plug the patient port.
4. Set the ACGO selector switch to ABS.
5. Ensure that the bellows is completely collapsed.
6. Measure the amount of time it takes to fill the bellows when the O_2 Flush button is fully and continuously depressed.
7. Repeat the above measurement two more times (deflate bellows by removing the plug from the patient port).
   - The bellows should fill in 1.8 to 2.3 seconds.

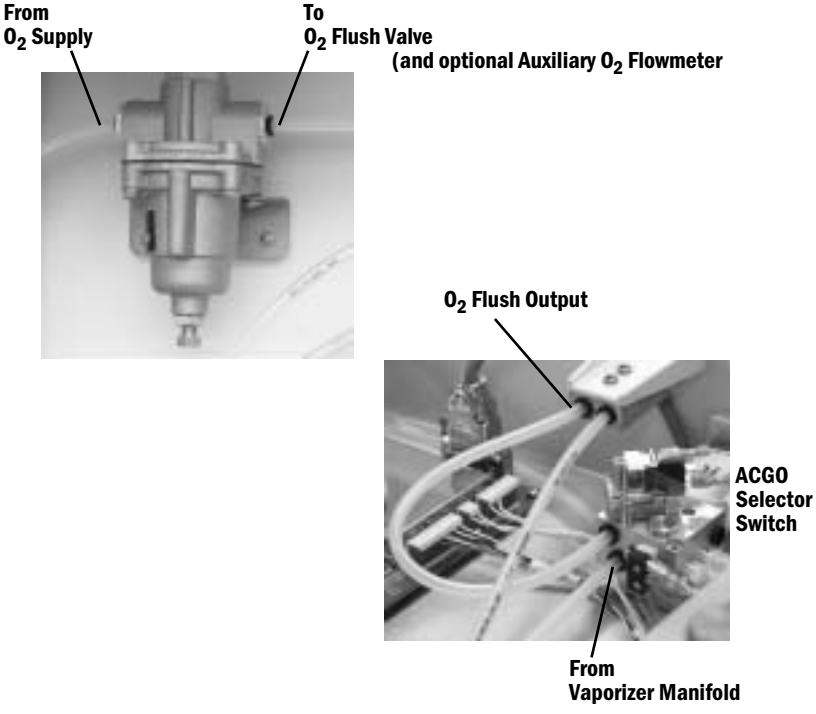
Without Ventilator:

1. Set the Bag/Vent switch to Bag.
2. Set the system switch to Standby.
3. Attach a patient circuit and plug the patient port.
4. Attach a 3-liter rebreathing bag on the bag arm or manual bag port (if a 3-liter bag is not available, use the time specified for a 1-liter bag times the volume of the bag used).
5. Set the ACGO selector switch to ABS.
6. Ensure that the rebreathing bag is completely collapsed.
7. Adjust the APL valve to maximum.
8. Measure the amount of time it takes to fill the rebreathing bag when the O_2 Flush button is fully and continuously depressed.

   Note: When the airway pressure gauge exceeds 10 cm H_2O, the rebreathing bag is full.
9. Repeat the above step two more times (deflate the rebreathing bag by removing the plug from the patient port).
   - A 3-liter bag should fill in 3.6 to 5.1 seconds.
   - A 1-liter bag should fill in 1.2 to 1.7 seconds.

Possible Causes of Failure

- Large leak (if long filling time).
- Flush regulator setting (Section 6.5).
- Flush regulator cross-connection (if long filling time).
- ACGO selector valve inlet cross-connection (if short filling time).



3.4 Vaporizer back pressure test

⚠ **WARNING** Anesthetic agent vapor comes out of the common gas outlet during this test. Use a safe, approved procedure to remove and collect the agent.

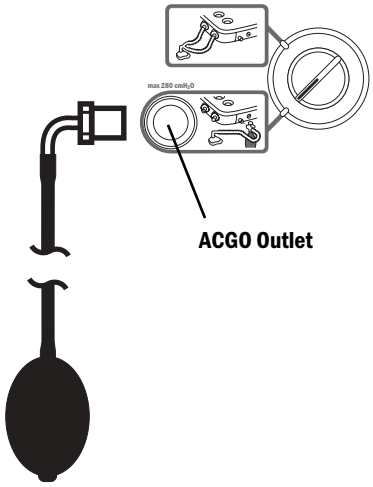
1. Set up the gas scavenging system.
   a. Connect the AGSS to a gas scavenging system.
   b. Attach a patient circuit and plug the patient port.
   c. Attach a bag to the bag port (or plug the bag port).
   d. Set the Bag/Vent switch to Bag.
   e. Adjust the APL valve to minimum.
2. Set the ACGO selector switch to ABS.
3. Set the system switch to On.
4. Set the O_2 flow to 6 L/min.
5. Make sure that the O_2 flow stays constant and the float moves freely.
6. Adjust the vaporizer concentration from 0 to 1% one click at a time. The O_2 flow must not decrease more than 1 L/min through the full range. If the O_2 flow decreases more than 1 L/min:
   a. Install a different vaporizer and try this step again.
   b. If the O_2 flow decreases less than 1 L/min with a different vaporizer, the malfunction is in the first vaporizer.
   c. If the O_2 flow also decreases more than 1 L/min with a different vaporizer, the malfunction is in the Aespire system. Do not use the system until it is serviced (repair vaporizer manifold port valve).
7. Complete steps 3 through 5 for each vaporizer and vaporizer position.
8. Set the system switch to Standby.

3.5 Low-pressure leak test

Note Perform either the “Negative low-pressure leak test” or the “ISO or BSI standard low-pressure leak test. It is not necessary to perform both tests.

⚠ WARNING Do not use a system with a low-pressure leak. Anesthetic gas will go into the atmosphere, not into the breathing circuit.

3.5.1 Negative low-pressure leak test



1. Test the leak test device:
   a. Put your hand on the inlet of the leak test device. Push hard for a good seal.
   b. Squeeze the bulb to remove all air from the bulb.
   c. If the bulb completely inflates in less than 60 seconds, replace the leak test device.
2. Set the system switch to Standby.
3. Set the ACGO selector switch to ACGO.
4. Turn off all vaporizers.
5. Test the anesthesia machine for low-pressure leaks:
   a. Open the flow controls one and a half turns counterclockwise.
   b. Connect the test device to the ACGO outlet.
   c. Compress and release the bulb until it is empty.
   d. The vacuum causes the floats to move. This is usual. If the bulb completely inflates in 30 seconds or less, there is a leak in the low-pressure circuit.
6. Test each vaporizer for low-pressure leaks:
   a. Set the vaporizer to 1%.
   b. Repeat step 5.
   c. Set the vaporizer to OFF.
   d. Test the remaining vaporizers.
7. Disconnect the test device.
8. Turn all flow controls fully clockwise (minimum flow). Do not over tighten.

⚠ WARNING Agent mixtures from the low-pressure leak test stay in the system. Always flush the system with O_2 after the low-pressure leak test (1 L/min for one minute).

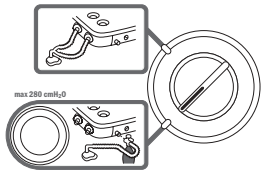
Turn off all vaporizers at the end of the low-pressure leak test.

9. Flush the system with O_2:
   a. Set the system switch to On.
   b. Set the O_2 flow to 1 L/min.
   c. Continue the O_2 flow for one minute.
   d. Turn the O_2 flow control fully clockwise (minimum flow).
   e. Set the system switch to Standby.

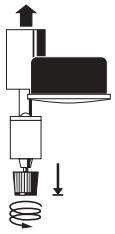
3.5.2 ISO or BSI standard low-pressure leak test

⚠ CAUTION Do the positive pressure leak test at the ACGO outlet only.

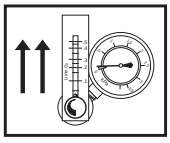
1. Set the ACGO selector switch to ACGO.
2. Turn all flow controls fully clockwise (minimum flow).
3. Using the positive pressure leak test adapter, connect the ISO or BSI specific leak test device to the ACGO outlet. Push the adapter into the ACGO outlet throughout the test to get a good seal.



Leak Test Adapter



Test Device (Top View)



Test Device (Front View)

4. Keep flowmeter of the test device vertical for accurate results.
5. Fully open the needle valve on the test device (counterclockwise).

⚠ CAUTION If the needle valve is not fully open, this test can damage the pressure gauge on the test device.

6. Set the system switch to On.

7. Open the O_2 flow control and set a total flow of 0.4 L/min through the flowmeter on the test device.
8. Make sure that the pressure gauge on the test device reads zero and that all other flow controls are fully closed.
9. Close the needle valve on the test device until the test gauge reads:

ISO 5358	**3 kPa**
BSI 4272.3	**20 kPa**

10. If the flow through the test device is less than
    0.35 L/min (ISO) or
    0.3 L/min (BSI),
    there is a low pressure leak in the anesthesia machine.
11. Fully open the needle valve on the test device to decrease the back pressure.
12. Test each vaporizer for low-pressure leaks:
    a. Set the vaporizer to 1%.
    b. Repeat steps 7 through 10.
    c. Turn the vaporizer OFF.
    d. Test the remaining vaporizers.
13. Remove test tool and adapter.

⚠ WARNING Agent mixtures from the low-pressure leak test stay in the system. Always flush the system with O_2 after the low-pressure leak test (1 L/min for one minute).

Turn all vaporizers OFF at the end of the low-pressure leak test.

14. Flush the system with O_2:
    a. Set the system switch to On.
    b. Set the O_2 flow to 1 L/min.
    c. Continue the O_2 flow for one minute.
    d. Turn the O_2 flow control fully clockwise (minimum flow).
    e. Set the system switch to Standby.

3.6 Alarm tests

1. Connect a test lung to the patient connection.
2. Set the Bag/Vent switch to Vent.
3. Set the system switch to On.
4. Set the controls:
   - Ventilation Mode: Volume control (select from main menu)
   - Ventilator:
     - Tidal Vol: 400 ml
     - Rate: 12
     - I:E Ratio:1:2
     - Plimit:40 cm H_2O
     - PEEP: OFF
   - Anesthesia Machine:
     - O_2 flow: minimum flow
     - All other gases: OFF
     - ACGO selector switch to ABS
5. Push O_2 Flush to fill the bellows.
6. Set the Bag/Vent switch to Bag and back to Vent.
7. Make sure that:
   a. Mechanical ventilation starts.
   b. A subatmospheric pressure alarm does not occur.

      Note: With active gas scavenging, too much scavenging flow can cause subatmospheric alarm.
   c. The ventilator displays the correct data.
   d. The bellows inflate and deflate during mechanical ventilation.
8. Set the O_2 flow control to 5 L/min.
9. Make sure that:
   a. The end expiratory pressure is approximately 0 cm H_2O.

      Note: Positive end expiratory pressure when PEEP is off may indicate that the scavenging system is not removing enough gas.
   b. The ventilator displays the correct data.
   c. The bellows inflate and deflate during mechanical ventilation.
10. Test the low minute volume alarm:
    a. Go to the alarms menu.
    b. Set the alarm limit for low minute volume to 6.0 L/min.
    c. Make sure that a low minute volume alarm occurs.
    d. Go to the alarms menu.
    e. Set the low minute volume alarm to OFF.

11. Test the high airway pressure alarm:
    a. Set P_{limit} to less than the peak airway pressure.
    b. Make sure that the high airway pressure alarm occurs.
    c. Set P_{limit} to correct level.
12. Test the apnea and low airway pressure alarms:
    a. Turn all flow controls fully clockwise.
    b. Remove the test lung from the patient connection.
    c. Other alarms such as low minute volume can occur.
    d. Make sure that the low airway pressure and apnea alarms occur. The apnea alarm occurs after 30 seconds.
13. Test the sustained airway pressure alarm:
    a. Set the controls:
       - APL valve — Closed (70)
       - Bag/Vent switch — Bag
    b. Mechanical ventilation stops when the Bag/Vent switch is set to Bag.
    c. Occlude the bag port connector with a test plug.
    d. Close the patient connection using the test plug located on the side of the ABS and push the O_2 Flush button.
    e. Make sure that the sustained pressure alarm occurs after approximately 15 seconds at the sustained pressure limit (6-30 cm H_2O varies with pressure limit).
14. Test the O_2 monitor and alarms:
    a. Remove the O_2 sensor from the circuit module.
    b. Make sure the sensor measures approximately 21% O_2 in room air.
    c. Set the low O_2 alarm to 50%. Make sure a low O_2 alarm occurs.
    d. Set the low O_2 alarm back to 21% and make sure that alarm cancels.
    e. Put the O_2 sensor back in the circuit.
    f. Remove the test lung from the patient connection.
    g. Set the High O_2 alarm to 50%.
    h. Push the flush button to fill the breathing system.
    i. Set the O_2 flow control to 2 L/min.
    j. Make sure the high O_2 alarm comes On.
    k. Set the high O_2 alarm back to 100% and make sure that alarm cancels.
    l. After 2 minutes in pure O_2, the O_2 display reads approximately 100%.
    m. Turn the O_2 flow control fully clockwise (minimum flow).
15. Set the system switch to Standby.

3.7 Breathing system tests

⚠ WARNING Objects in the breathing system can stop gas flow to the patient. This can cause injury or death:

- Do not use a test plug that is small enough to fall into the breathing system.

1. Verify that AGSS is operating. For systems that have a flow indicator on the side, make sure that the flow indicator shows a flow in the green (normal) region.
2. Zero the pressure gauge (Section 6.6.1).

Check Valves

3. Make sure that the check valves on the breathing circuit module work correctly:
   a. The Inspiratory check valve rises during inspiration and falls at the start of expiration.
   b. The Expiratory check valve rises during expiration and falls at the start of inspiration.

Ventilator Bellows

4. Ventilator bellows test:
   a. Set the system switch to Standby.
   b. Set the Bag/Vent switch to Ventilator.
   c. Set all flow controls to minimum.
   d. Close the breathing circuit at the patient connection. Use the test plug located on the side of the ABS.
   e. Push the O_2 flush button to fill the bellows.
   f. The pressure must not increase to more than 15 cm H_2O on the pressure gauge.
   g. If the bellows falls more than 100 mL/min (top of indicator), it has a leak.

Service Mode Tests

5. Enter the Service Mode: Push and hold the adjustment knob on the ventilator's display and set the system switch to On.
   a. Select and confirm "Service Modes."
   b. Follow the menu structure outline below to reach the adjustment for the inspiratory flow valve. Select and confirm at each step.
      - "Diagnostics Tests/Tools"
      - "Breathing System Leak Test"
   c. Follow the instructions on the screen.
   d. The leak rate should be less than 200 mL/min.
      For machines with a single-tube O_2 flowmeter, the pressure reading should reach 30 cm H_2O at minimum flows greater than 200 mL/min.

Note: If test fails, see Section 7.2, "Breathing System Leak Test Guide".

Bag Circuit

6. Test the Bag circuit for leaks:
   a. Set the system switch to On.
   b. Set the Bag/Ventilator switch to Bag.
   c. Plug the Bag port (use your hand or the approved test plug).
   d. Close the APL valve (70 cm H_2O).
   e. Set the O_2 flow to 0.25 L/min.
   f. Close the patient connection (using a hand or test plug on the side of the breathing system) and pressurize the bag circuit with the O_2 flush button to approximately 30 cm H_2O.
   g. Release the flush button. The pressure must not decrease. A pressure decrease large enough to see on the gauge indicates an unacceptable leak.

Note: If test fails, see Section 7.2, “Breathing System Leak Test Guide”.

APL Valve

7. Test the APL valve:
   a. Fully close the APL valve (70 cm H_2O).
   b. Set the total fresh gas flow to approximately 3 L/min and make sure that the value on the inspiratory pressure gauge does not exceed 85 cm H_2O. Some pressure fluctuation is normal.
   c. Fully open the APL valve (to the MIN position).
   d. Set O_2 flow to 3 L/min. Turn any other gases off.
   e. Make sure that the value on the inspiratory pressure gauge is less than approximately 5 cm H_2O.
   f. Push the O_2 flush button. Make sure that the value on the inspiratory pressure gauge stays less than 10 cm H_2O.
   g. Set the O_2 flow to minimum and make sure that the value on the inspiratory pressure gauge does not decrease below 0 cm H_2O.
8. Remove your hand or the test plug from the patient connection.
9. Set the System switch to Standby.

⚠ WARNING Make sure that there are no test plugs or other objects caught in the breathing system.

3.8 Auxiliary O_2 flowmeter tests

1. Open the O_2 cylinder valve or connect an O_2 pipeline.
2. Rotate the flow control clockwise (decrease) to shut off the flow. The ball should rest at the bottom of the flow tube and not move.
3. Rotate the flow control counterclockwise (increase). The ball should rise immediately after rotation is begun. It should rise smoothly and steadily with continued counterclockwise rotation. When a desired flow is set, the ball should maintain in a steady position.
4. Occlude the auxiliary O_2 outlet. The ball should rest at the bottom of the flow tube and not move. A ball that does not rest at the bottom of the flow tube indicates a leak and requires service.
5. Rotate the flow control clockwise to shut off the flow.

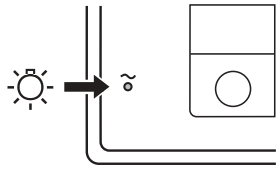
3.9 Integrated Suction Regulator tests

The gauge needle should come to rest within the zero range bracket when no suction is being supplied. Gauges which do not comply may be out of calibration.

1. Adjust the regulator setting to minimum.
2. Turn the mode selector to I (On).
3. Ensure the gauge remains less than 200 mmHg (26 kPa, 0.26 Bar).
4. Occlude the inlet.
5. Ensure the gauge remains less than 200 mmHg (26 kPa, 0.26 Bar).
6. Adjust the regulator in an increasing vacuum level.
7. The gauge should rise after rotation has begun. The gauge should rise with continued rotation of the regulator adjustment.
8. Adjust the regulator setting to minimum.
9. Turn the Mode selector to O (Off).

3.10 Power failure test

1. Connect the power cord to a mains outlet. The mains indicator on the display comes on when AC Power is connected.



   If the indicator is not on, the display assembly is not receiving AC power.

   - Verify AC power to the machine (reset circuit breaker).
   - Check fuses in display assembly's inlet module.
   - Check fuses in machine's AC inlet assembly.

2. Set the system switch to On.
3. Unplug the power cord with the system turned on.
4. Make sure that the power failure alarm comes on.
5. Make sure the following message is on the ventilator display:
   - "On Battery - Power OK?"
6. Connect the power cable again.
7. Make sure the alarm cancels.

3.11 Electrical safety tests

Make sure the system is completely assembled and all accessory devices are connected to electrical outlets.

1. Connect an approved test device (e.g. UL, CSA, or AAMI) and verify that the leakage current is less than:

Voltage	Max. Leakage Current
120/100 Vac	300 μAmps
220/240 Vac	500 μAmps

2. Make sure that the resistance to ground is less than 0.2Ω between an exposed metal surface and the ground pin on the power cord.

Notes

4 Repair Procedures

In this section

This section covers the repair and replacement procedures for components of the Aespire anesthesia machine.

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⚠ **WARNING** To prevent fires:

- Use lubricants approved for anesthesia or O_2 equipment, such as Krytox.
- Do not use lubricants that contain oil or grease; they burn or explode in high O_2 concentrations.
- All covers used on the system must be made from antistatic (conductive) materials. Static electricity can cause fires.

⚠ Obey infection control and safety procedures. Used equipment may contain blood and body fluids.

⚠ A movable part or a removable component may present a pinch or a crush hazard. Use care when moving or replacing system parts and components.

⚠ Some internal parts have sharp edges and can cause cuts or abrasions. Use care when servicing internal components.

⚠ After repairs are completed, always perform the checkout procedure. Refer to Section 3 of this manual.

4.1 Servicing the ventilator

The Aespire anesthesia machine is configured with the 7100 Ventilator.

Service information for this ventilator is provided in a separate manual as detailed in Section 1.2.2.

The 7100 Ventilator comprises the following components:

- The Display/Control module.
- The Serial Isolation and Connector Board, located in the upper structure.
- The Vent Engine, located in the rear portion of the breathing system.
- The Ventilator Monitoring Board, located under the tabletop.

Common machine components such as switches and sensors which provide input to the ventilator are covered in this manual.

4.2 How to bleed gas pressure from the machine

Before disconnecting pneumatic fittings, bleed all gas pressure from the machine.

1. Set the system switch to On.
2. Close all cylinder valves and disconnect all pipeline supplies from the source.
   Note: If the machine includes N_2O, do not disconnect the O_2 pipeline.
   If pipeline O_2 is not available, open the O_2 cylinder valve.
3. Turn the flow controls for all gases (except O_2) at least one turn counterclockwise.
4. Ensure that all cylinder and pipeline gauges read zero before proceeding.
   - For machines with N_2O, disconnect the O_2 pipeline supply from the source (or close the O_2 cylinder valve).
   - Press the O_2 flush button to bleed O_2 from the system.
5. Set the system switch to Standby.

4.3 How to remove the rear panels

You must remove the rear upper panel to repair or replace many of the machine's components. To access the 3rd cylinder supply (if equipped) you must remove the lower access panels.

4.3.1 To remove the rear upper panel

1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Disconnect all electrical cables.
4. To remove the rear panel, fully loosen the three captive screws that hold the panel in place. Remove the panel.
   - If the machine includes integrated suction, disconnect the two tube fittings from the overflow safety trap manifold.
   - If the machine includes electrical outlets, lower the panel and place it so that it does not stress the power cable.

4.3.2 To remove the lower access panels

1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. If present, remove the inboard cylinders.
4. Remove (two screws) the small upper access panel to access the 3rd cylinder regulator (N_2O) test port.
5. Remove (six screws) the large lower access panel to access the 3rd cylinder regulator.

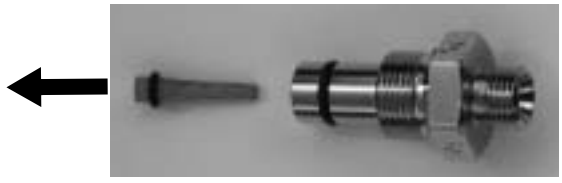
4.4 How to remove the tabletop

The tabletop is held in place with five captive screws along the periphery of the pan assembly (accessed from below the rim of the tabletop).

- One screw (**A**) is in a deep recess at the right-rear corner of the tabletop.
- Two screws (**B**) are at the front of the tabletop: one screw is at the right corner of the tabletop, one is near the O_2 Flush button.
- To access the remaining two screws (**C**), you must remove the ABS: one screw is at the left corner of the tabletop, one is near the APL Valve.

4.5 Replace pipeline inlet filter

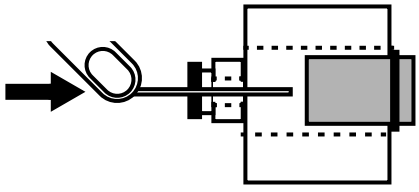
1. Remove the pipeline inlet fitting.
2. Pull the pipeline inlet filter out of the fitting. The o-ring should come out with the filter.



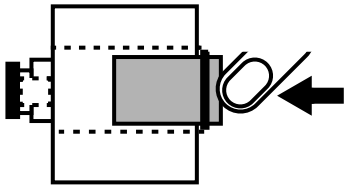
3. Install the new pipeline inlet filter in the pipeline inlet fitting. The new filter comes with an o-ring.

4.5.1 Replace pipeline inlet check valve

1. Remove the rear panel (Section 4.3).
2. Remove the pipeline inlet fitting.
3. The Air and O_2 pipeline manifolds include a drive gas connection at the back of the manifold. Remove the drive gas tube or plug to access the check valve.
4. From the back of the pipeline manifold, use a thin tool to push out the check valve. (For an N_2O manifold, you will have to carefully apply pressure at the outlet of the manifold — with a syringe for example — to gently force the check valve out of the manifold).



5. Push the new check valve into the opening, using the same thin tool. The new check valve includes an o-ring — orient it toward the pipeline inlet. **Note:** Make sure to push the new check valve all the way back into the opening until it bottoms out on the shoulder.



6. Install the pipeline inlet fitting.
7. Perform the checkout procedure (Section 3).

4.6 Change drive gas

⚠ **CAUTION** If you change the drive gas, you must also change the drive gas selection on the ventilator service setup screen. Refer to Section 4 of the ventilator Technical Reference manual.

- If the drive gas selection and the actual drive gas do not agree, volumes will not be correct.

The ventilator will alarm with the message “Low Drive Gas Press” if the selected drive gas pressure, either O_2 or Air, is lost.

1. Remove the rear panel (Section 4.3).

Note: The O_2 and Air pipeline manifolds have a drive gas connection at the back. The connection not in use is plugged.

2. Remove the plug from the new connection.
3. Disconnect the drive gas hose from the present connection.
4. Install the plug in this connection (pull on the plug to ensure that it is locked into the fitting).
5. Reroute the drive gas hose so that it does not cause kinks in other tubing.
6. Connect the drive gas hose to the new connection (pull on the hose connector to ensure that it is locked into the fitting).
7. Do a high-pressure leak test (Section 3.2).
8. Enter the service mode and select the correct drive gas.
9. Test the primary regulator. Verify that it functions within specifications now that it will be supplying drive gas to the ventilator (Section 6.1).
10. Perform the checkout procedure (Section 3).

4.7 Service the cylinder supply modules

⚠ WARNING Be careful not to expose internal components to grease or oil (except Krytox or equivalent).

4.7.1 Tightening procedure for high-pressure tube fittings

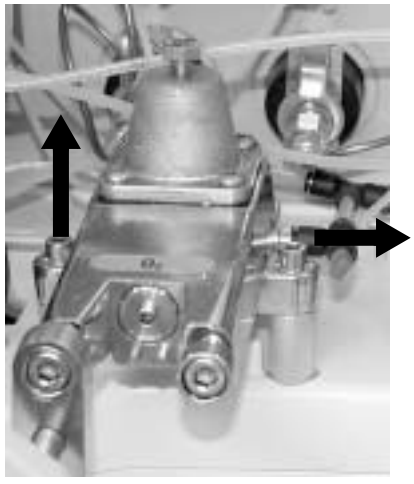
The cylinder pressure gauge is connected to the cylinder supply through a copper tube with fittings at both ends. Use the following tightening procedure whenever you are replacing a cylinder supply or a cylinder pressure gauge.

1. Insert the tubing into the fitting until the ferrule seats in the fitting.
2. Tighten the nut by hand.
3. Continue tightening the nut with a wrench until it reaches the original position (about 1/4 turn). You will feel an increase in resistance at the original position.
4. After reaching the original position, tighten the nut just slightly.

Note If you are installing a new tube that has not been tightened before, tighten the nut with a wrench an additional 3/4 of a turn after the nut is finger tight.

4.7.2 Replace primary regulator module (complete replacement)

1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Remove the rear panel (Section 4.3).
4. Disconnect the high-pressure cylinder gauge fitting.
5. Disconnect the output tube fitting.
6. Remove the three mounting screws and lockwashers.
7. To reassemble, perform the previous steps in reverse order.
   - Tighten the high-pressure fitting as detailed in Section 4.7.1
   - Pull on the cylinder output fitting to ensure it is locked in place.
8. Check the output of the regulator BEFORE you install the rear panel. Adjust if necessary (Section 6.1).
9. Perform the checkout procedure (Section 3).

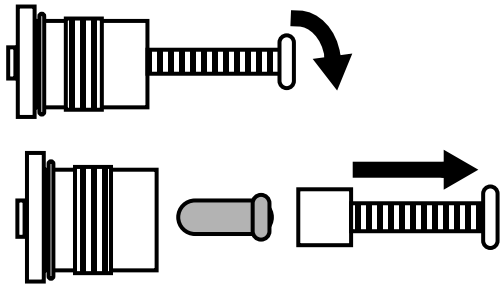


4.7.3 Replace cylinder inlet filter

1. Open the cylinder yokes.
2. Remove the inlet adapter from the cylinder yoke, using a 4 mm hex wrench.

   Note: A brass retaining ring keeps the filter inside the inlet adapter.
3. Thread a 6-mm screw (two turns only) into the brass retaining ring and pull it out.

⚠ **CAUTION** Be careful not to crush the filter. Do not thread in the screw more than two full turns.



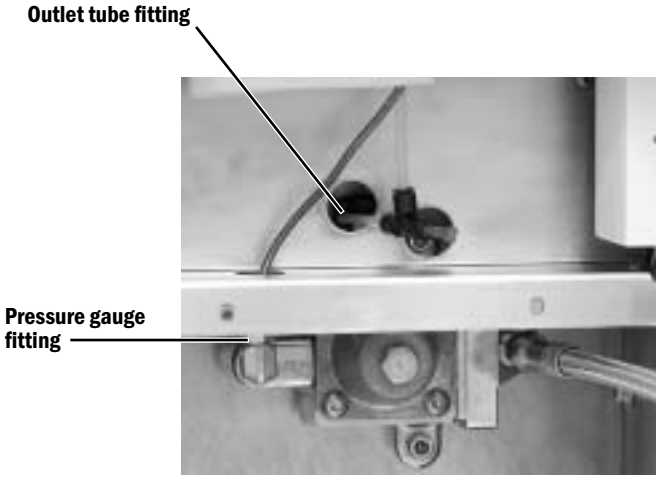
4. Remove the filter.
5. Install the new filter and brass retaining ring.
6. Install the inlet adapter in the cylinder yoke.
7. Perform the checkout procedure (Section 3).

4.7.4 Replace cylinder check valve

The cylinder check valve is not a replaceable item. If the check valve is defective, you must replace the complete cylinder supply module.

4.7.5 Replace 3rd-gas cylinder supply module

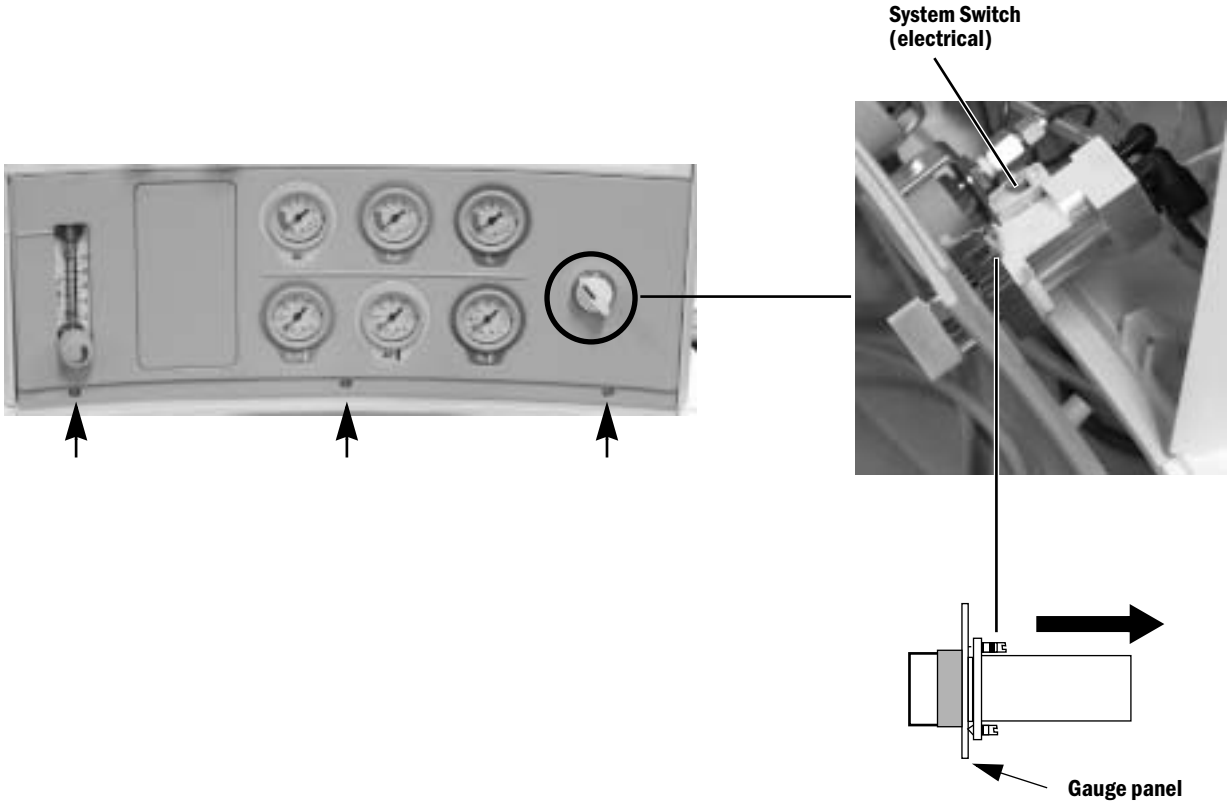
1. Remove the lower rear cover (Section 4.3.2).
2. Disconnect the high-pressure cylinder gauge fitting.
3. Disconnect the output tube fitting.
4. Remove the three mounting screws and lockwashers.



5. To reassemble, perform the previous steps in reverse order.
   - Tighten the high-pressure fitting as detailed in Section 4.7.1
   - Pull on the cylinder output fitting to ensure it is locked in place.
6. Check the output of the regulator BEFORE you install the rear cover. Adjust if necessary (Section 6.1).
7. Perform the checkout procedure (Section 3).

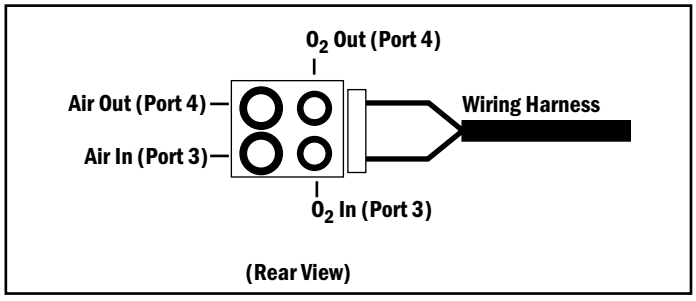
4.8 Replace system switch assembly

1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Remove the tabletop (Section 4.4).
4. Remove the gauge panel mounting screws and move the panel forward to access the system switch.



5. Disconnect the wires from the electrical switch.
6. Back out the system switch mounting screws just enough to allow the knob collar to be released.
7. While holding the switch assembly, push in the knob and turn it counterclockwise.
8. Pull the knob and collar out from the front and remove the switch assembly.

9. Install the replacement switch assembly:
   a. Loosen the two outside screws on the electrical module.
   b. Insert the wires in the electrical module and tighten the screws.
   c. Pull the wires on the electrical module to ensure that there is a good connection.
   d. Turn back the system switch mounting screws until their tips recede.
   e. Orient the switch assembly with the Air fittings toward the right and the O_2 fittings toward the left.
   f. Install the switch assembly through the gauge panel.
   g. Push the knob collar in with the indicator up and turn it clockwise until it locks.
   h. Tighten the mounting screws. Make sure that the top edge of the switch assembly is parallel to the top edge of the gauge panel.
   i. Transfer the tubing from the old system switch to the new system switch on the pneumatic module (pull on the tubing to ensure that it is locked into the module).

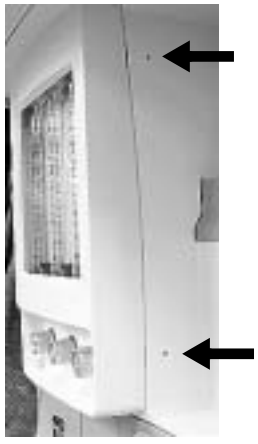


10. Test the replacement switch assembly:
    a. Connect Air and O_2 supplies.
    b. Connect the power cable to an electrical outlet.
    c. Set the system switch to On.
    d. Increase the O_2 and Air flow. Make sure that gas flows.
    e. Make sure that you do not feel or hear any leaks.
    f. Make sure that the display comes On.
    g. Set the system switch to Standby.
    h. Make sure all gas flow stops and the display turns Off.
11. Reinstall the gauge panel and the tabletop.
12. Perform the checkout procedure (Section 3).

4.9 Service the flowmeter module

4.9.1 Remove front flowmeter panel shield

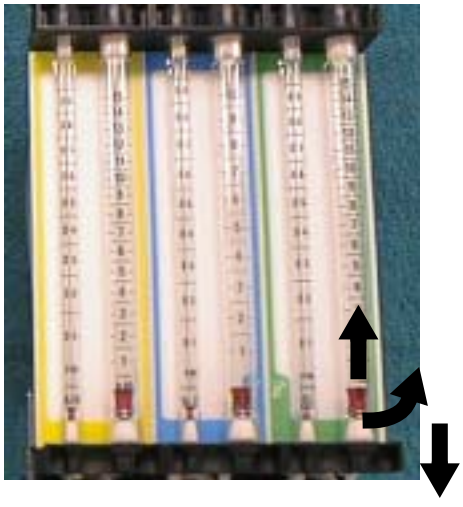
1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. The flowmeter panel is held in place with two latching tabs at the right side. To remove the panel, release each latch by pushing it toward the center of the panel with a thin rod (3-mm hex wrench) through the access hole in the shroud.



4. Remove the panel.
5. To reinstall the panel, engage the retaining tabs on the left side and press the right side against the shroud to latch it in place.

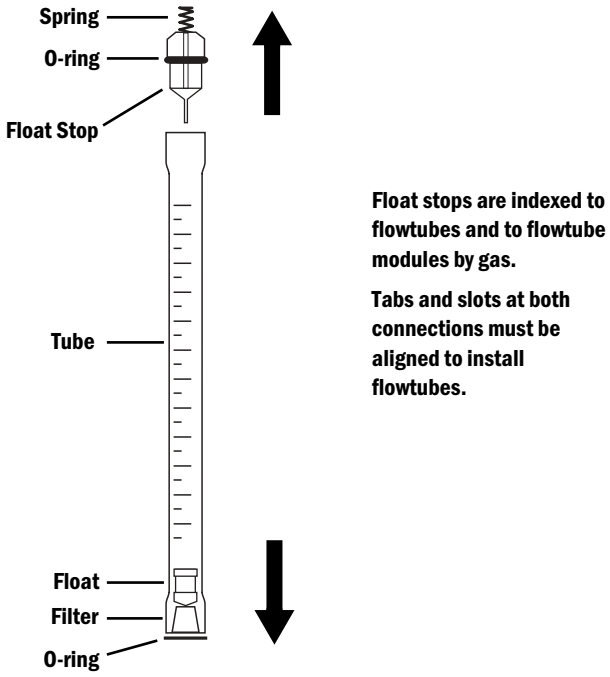
4.9.2 Remove flowtubes for cleaning or replacement

1. Remove the front flowmeter panel shield (Section 4.9.1).
2. To remove a flowtube assembly, push up on the tube just enough to clear the bottom seal, pull out from the bottom until the tube clears the flowtube module, then pull down slowly to release it from the module.



⚠ WARNING Floats are calibrated to a specific tube. Keep each float with its tube. Replace tube and floats together. Interchanging floats can cause incorrect readings. Disassemble the flowtube assemblies only when service is required. Excessive cleaning can remove the antistatic coating from inside the tube. Damage to the float requires replacement of the entire flowtube.

3. Disassemble the flowtube assembly.

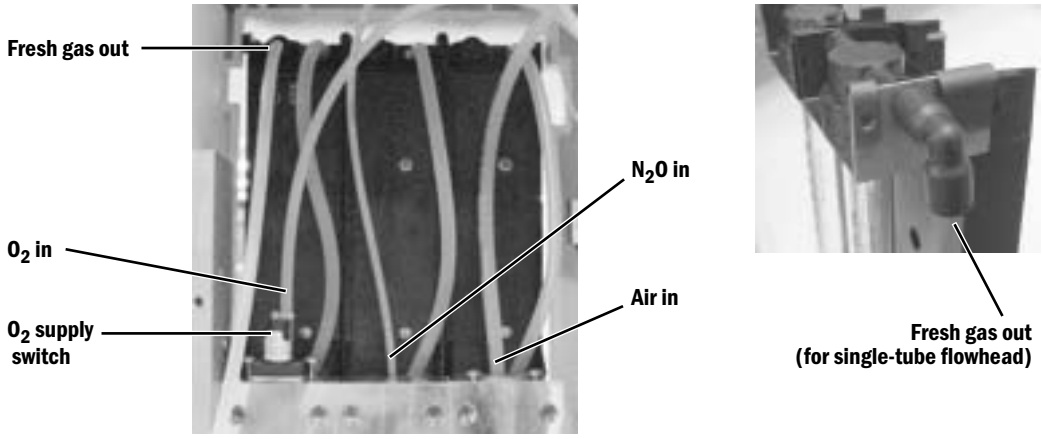


4. Completely clean, rinse, and dry the flowtube. Use hospital grade alcohol and a flowtube brush.
5. Replace stops, filter and o-rings, as necessary. Lightly coat all o-rings with Krytox. Be careful to not get any Krytox on the bottom of small flowtube float stops.
6. Reassemble the flowtube assembly.
7. Insert the flowtube, spring side first, into the top of the module with the scale oriented forward.
8. Push up and slide the bottom of the flowtube into place on the bottom o-ring. It may be necessary to rotate the tube to engage the index tabs.

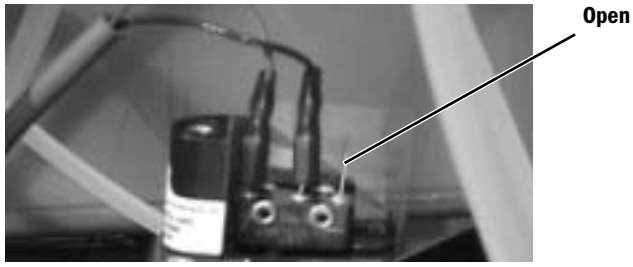
   Note: Be sure o-rings are inserted completely into the collar.
9. Push down on the tube to seat the bottom o-ring.
10. Reinstall the front flowmeter panel shield.
11. Perform the checkout procedure (Section 3).

4.9.3 Remove complete flowmeter head

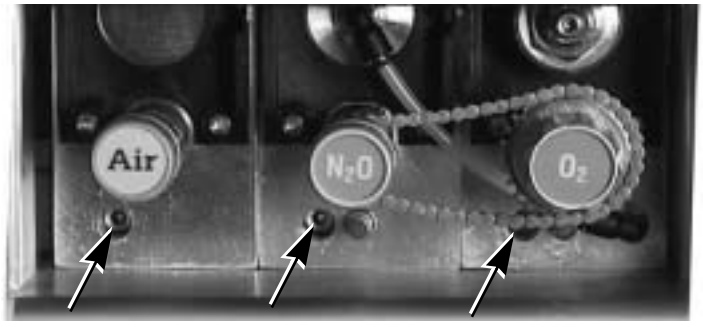
1. Remove the rear panel (Section 4.3).
2. Disconnect the tubing at the rear of each gas module. The following example is a back view of the flowmeter head.



3. Disconnect the O_2 supply switch harness. Note position of switch connections so that you can reassemble correctly later.



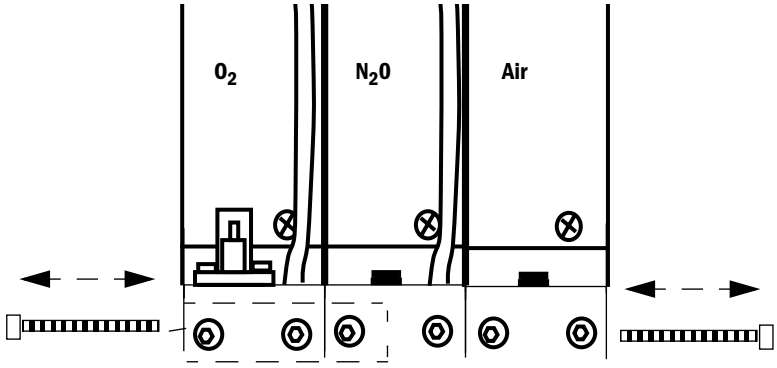
4. Remove the front flowmeter panel shield (Section 4.9.1).
5. Remove the mounting screw from each regulator manifold.



6. Pull the flowhead forward.
7. To reinstall, perform the previous steps in reverse order (pull on the tubing to ensure it is locked into the fittings).
8. Check for proper alignment of the front flowmeter panel. If any of the needle valve knobs rub against the flowmeter panel, reposition the flowhead to allow for proper clearance.
9. Perform the checkout procedure (Section 3).

4.9.4 Replace flowmeter modules

1. Remove the complete flowmeter head (Section 4.9.3).
2. Refer to the following illustrations. Note that these illustrations show ANSI flowmeter module positions. The order is reversed in ISO machines.



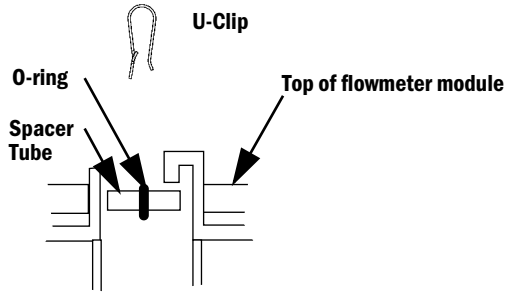
O_2/Air modules

O_2/Air flowmeter modules are connected at the bottom with a long screw (**A**) and nut (**B**) that is recessed. To remove, retain nut while loosening screw.

Note

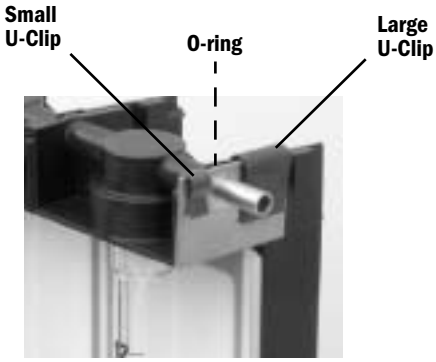
The flowmeter modules are held together at the top with a u-clip. To separate the modules, pivot the modules (front to back) 45 degree. The u-clip will disengage and allow the modules to separate.

The flowmeter modules are interconnected at the top by a spacer tube. The o-ring on the spacer tube makes a leak-tight seal.



Single-tube flowhead

The outlet fitting for a single-tube flowhead is not an integral component of the O_2 flowmeter. The outlet fitting is a separate component that includes an o-ring seal and is held in place with two u-clips.



3. To remove the Air flowmeter module:

a. Remove the screw located on the side of the Air flowmeter module.

b. Hold the flowmeter module with the flowtubes facing you.

c. Grasp the outer modules at the bottom of the regulator manifold and push the left module away from you until the u-clip pops off and the module separates from the other assemblies.

d. Pull the modules sideways to separate them at the top.
Save the u-clip, spacer tube, and the o-ring for reassembly.

4. To remove the O_2 or N_2O flowmeter module:

a. Set the O_2 and N_2O needle valves to their maximum position (counterclockwise).

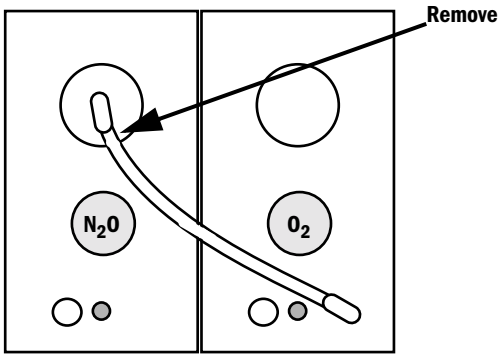
b. Loosen the set screws on the N_2O knob, then remove the knob.

c. Loosen the set screws on the N_2O sprocket and the O_2 knob.

d. To remove, grasp the O_2 knob/sprocket, N_2O sprocket, and chain as an assembly. Remove as an assembly.

e. Remove the spacer from the N_2O needle valve spindle.

f. Remove the pilot tube going to the balance regulator.



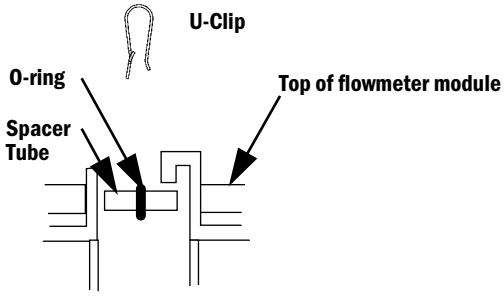
g. The O_2 and N_2O flowmeter modules are held together by a single screw. Remove the screw located on the side of the O_2 flowmeter module.

h. Hold the flowmeter modules with the flowtubes facing you.

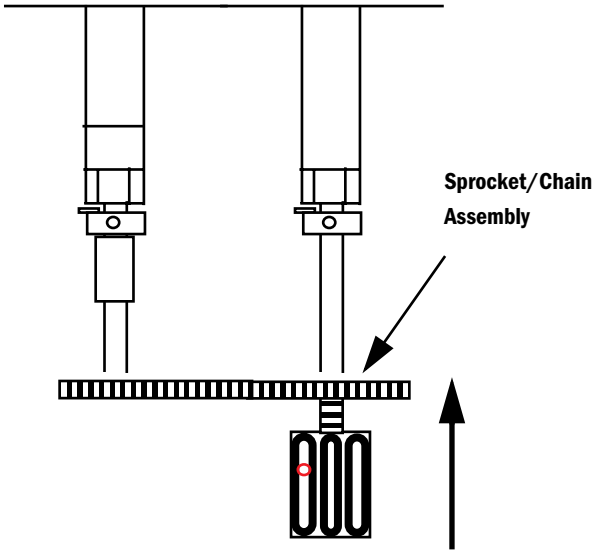
i. Grasp the modules at the bottom of the regulator manifolds and push the left module away from you until the N_2O module separates from the O_2 module.

j. Pull the modules sideways to separate them at the top.
Save the u-clip, spacer tube, and the o-ring for reassembly.

5. To reassemble the flowmeter modules, perform the previous steps in reverse order.
Note: The u-clips must be reinstalled with the barbed leg to the left as viewed from the front.



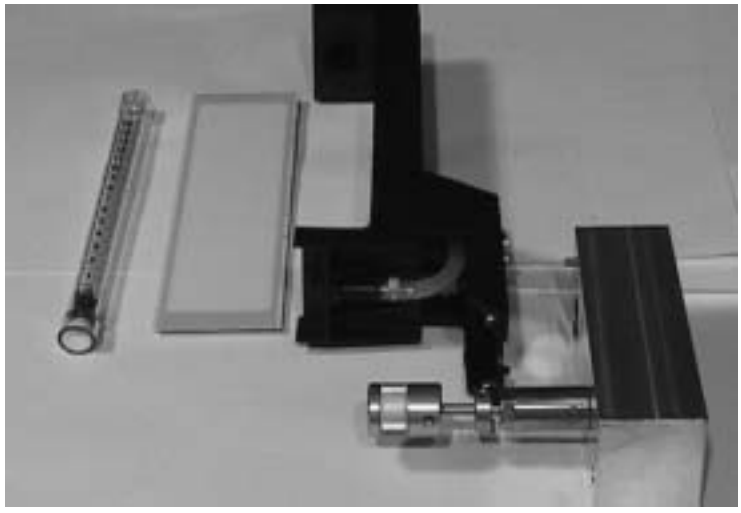
6. Install the screw through the O_2 flowmeter module to locks the O_2 and N_2O flowmeter modules together.
7. Reattach the pilot tube that goes to the balance regulator.
8. Install the flowhead into the machine. Reconnect the tubing and the O_2 supply switch harness.
9. Confirm needle valve calibration (Section 6.3).
10. Install the spacer on the N_2O needle valve stem.
11. Install the chain on the O_2 knob/sprocket assembly and the N_2O sprocket.
12. Install the chain and sprockets on the needle valve stems as an assembly. Do not tighten the set screws.



13. Install the N_2O knob. Snug one set screw to hold the knob in place.
14. Perform the link system calibration (Section 6.4).
15. Install the flowmeter panel shield.
16. Perform the checkout procedure (Section 3).

4.9.5 Replace flowmeter frame

1. Remove the front flowmeter panel shield (Section 4.9.1).
2. Remove the complete flowmeter head (Section 4.9.3).
3. Separate the flowmeter modules as required (Section 4.9.4).
4. Remove the flowtubes (Section 4.9.2). Keep all the parts for reassembly.
5. Remove the gas identification panel by removing the two screws at the back of the frame. Keep all the parts for reassembly.



6. Remove the flowmeter frame by loosening the four mounting screws at the back of the regulator manifold.

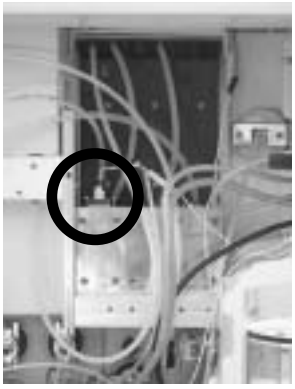
   Note: There is a retainer in each screw location that keeps each screw within the manifold.

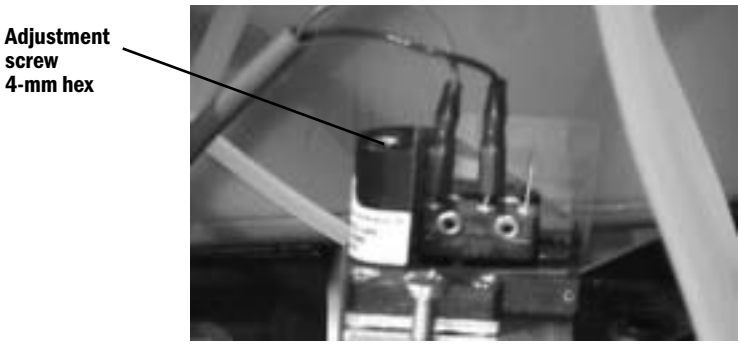
7. To reassemble, perform the previous steps in reverse order.
8. If replacing O_2 or N_2O frames, perform the link system calibration (Section 6.4).
9. Perform the checkout procedure (Section 3).

4.9.6 Replace O_2 supply switch

The O_2 supply switch is located on the O_2 flowmeter's regulator module.

1. Remove the upper rear panel (Section 4.3).
2. Remove the two mounting screws from the O_2 supply switch.





3. Pull the O_2 supply switch out of the regulator manifold.
4. Install the replacement O_2 supply switch.
5. Tighten the screws.
6. Disconnect the leads from the old switch and reconnect them to the new switch.
7. Adjust the alarm threshold for the new O_2 supply switch, as explained in the checkout procedure below (Section 4.9.7).
8. Replace the rear panel.
9. Perform the checkout procedure (Section 3).

4.9.7 Checkout procedure for O_2 supply switch

1. Remove the upper rear panel (Section 4.3).
2. Attach a gauge to the O_2 primary regulator test port. (On pipeline only machines, attach the gauge to a 6-mm O_2 port).
3. Adjust the O_2 flow control to minimum flow (clockwise).
4. Install an O_2 cylinder and open the cylinder valve (for pipeline only, connect O_2 pipeline source).
5. Turn the system on.
6. Close the cylinder valve (disconnect pipeline from source) and watch the test gauge as the O_2 pressure bleeds down slowly.

   Note: The "No O_2 pressure" alarm should occur between descending pressure of 221–193 kPa (32–28 psi).
7. If adjustment is required, set the adjustment screw so that the "No O_2 pressure" alarm occurs at 207 ±7 kPa (30 ±1 psi).
8. Disconnect the gauge and plug the test port
9. To reassemble, perform the previous steps in reverse order.
10. Perform the checkout procedure (Section 3).

4.9.8 Replace secondary regulator manifold or balance regulator manifold

1. Remove the front flowmeter panel shield (Section 4.9.1).
2. Remove the complete flowmeter head (Section 4.9.3).
3. Separate the flowmeter modules (Section 4.9.4).
4. Remove the flowmeter frame from the regulator manifold by removing the four screws at the rear of the regulator manifold (no need to remove flowtubes).
5. Remove the needle valve from the regulator manifold:
   a. Unscrew the complete assembly together (stop collar, needle valve).
   b. Replace the o-ring if necessary.
6. Screw the needle valve into the new regulator manifold.
7. Remove the plugs and balance regulator elbow fitting (and O_2 supply switch if an O_2 module) from the old regulator manifold.
8. Install the plugs and balance regulator elbow fitting (and O_2 supply switch if an O_2 module) into the new regulator manifold (pull on the plugs and fittings to ensure that they are locked into the manifold).
9. Reinstall the flowmeter frame to the regulator manifold.
10. Reinstall all the flowmeter modules to the flowmeter head.
11. Reinstall the flowmeter head (Section 4.9.4).
12. Do the necessary calibrations (Section 6).

Necessary calibrations	Section
Secondary Regulator	6.2
O_2 minimum flow	6.3.1
Maximum flow	6.3.4
Link system	6.4

13. Reinstall the front flowmeter panel shield.
14. Perform the checkout procedure (Section 3).

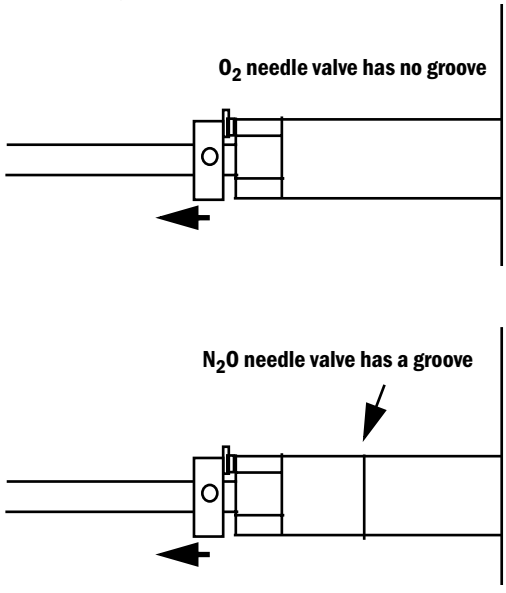
4.9.9 Replace O_2 or N_2O needle valves (on machines with N_2O)

For machines without N_2O, refer to Section 4.9.10 for replacing the O_2 needle valve.

1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Remove the front flowmeter panel shield (Section 4.9.1).
4. Set the O_2 and N_2O needle valves to their minimum position.
5. Loosen the set screws on the N_2O knob, then remove the knob.
6. Loosen the set screws on the N_2O sprocket and the O_2 knob.
7. To remove, grasp the O_2 knob/sprocket, N_2O sprocket, and chain as an assembly. Remove as an assembly.
8. Remove the spacer from the N_2O needle valve spindle.
9. Loosen the set screws on the needle valve stop collar for the needle valve that is being replaced.
10. Remove the stop collar.
11. To remove the needle valve from the flowmeter block, turn the needle valve counterclockwise with a 16-mm wrench.
12. To install the new needle valve, turn it clockwise and tighten it with the wrench.

    Note: Be sure the o-ring is properly located on the tip of the needle valve.

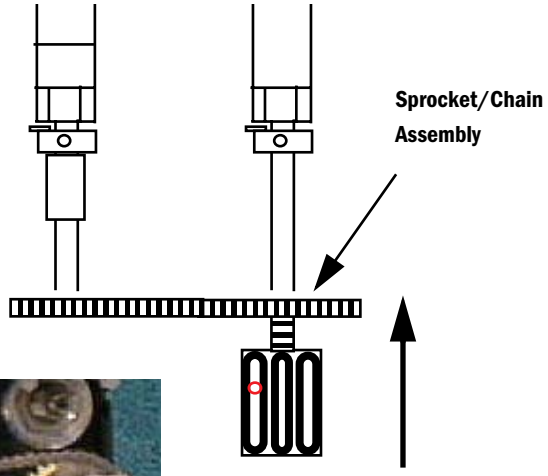
⚠ WARNING The O_2 and N_2O needle valves are not the same. Patient injury can result if the wrong needle valve is installed in the flowmeter block. You can identify the N_2O needle valve by a groove located just below the top brass hex.



13. Install the stop collar on the new needle valve. Do not tighten the set screws.
14. Perform the needle valve calibration (Section 6.3).

15. After calibrating the needle valve, put the spacer the N_2O needle valve spindle.

16. Put the chain on the O_2 knob/sprocket assembly and the N_2O sprocket.
17. Install the chain and sprockets on the needle valve spindles as an assembly. Do not tighten the set screws.



18. Install the N_2O knob. Do not tighten the set screws.
19. Perform the link system calibration (Section 6.4).
20. Install the flowmeter panel shield.
21. Perform the checkout procedure (Section 3).

4.9.10 Replace an Air needle valve on all machines or an O_2 needle valve on machines without N_2O

For machines with N_2O, refer to Section 4.9.9 for replacing the O_2 needle valve.

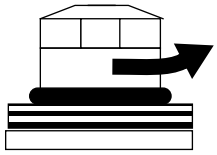
1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Remove the front flowmeter panel shield (Section 4.9.1).
4. Loosen the set screws on the flow control knob and remove the knob.
5. Loosen the set screws on the stop collar and remove the collar.
6. If equipped, remove the maximum flow stop collar.
7. Using a 16-mm wrench, remove the needle valve by turning it counterclockwise.
8. Install the new needle valve and tighten.

   Note: Be sure the o-ring is properly located on the tip of the needle valve.
9. If equipped, install the maximum flow stop collar (do not tighten).
10. Install the stop collar (do not tighten the screws).
11. Install the flow control knob on the shaft. Tighten one set screw to snug.
12. Reconnect the gas supplies.
13. Perform the flow control stop procedures explained in:
    - Section 6.3.1 for O_2.
    - Section 6.3.3 for Air.
    - Section 6.3.4 for maximum flow.
14. Install the flowmeter panel shield.
15. Perform the checkout procedure (Section 3).

4.10 Service vaporizer manifold parts

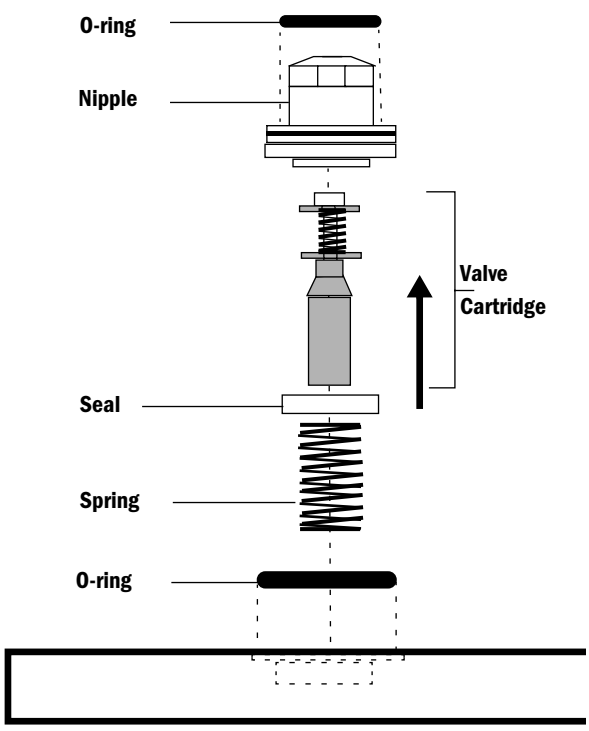
4.10.1 Repair manifold port valve

1. Set the system switch to Standby.
2. Remove the vaporizers from the vaporizer manifold.
3. Using a 14-mm wrench, carefully remove the valve nipple (threaded).



4. Disassemble as necessary to replace parts. The following illustration shows the parts.

Note: The port valve replacement kit includes the valve cartridge assembly and the seal. The kit does not include o-rings.



5. When installing a new valve cartridge assembly into the vaporizer manifold, put a light coat of Krytox on the bottom portion of the cartridge. The bottom portion of the cartridge is defined as the brass surface that is inserted in the lower spring. **Note:** Do not apply Krytox to the valve seal.
6. Verify that the parts are free of dust and dirt.
7. To reassemble, perform the previous steps in reverse order.
8. Complete the port valve checkout procedure described below (Section 4.10.2).

4.10.2 Checkout procedure for manifold port valve

Use the Vaporizer Manifold Valve Test Tool to perform the checkout procedure for the manifold port valve. This tool and test procedure are intended for use only when the valve cartridge assembly is replaced.

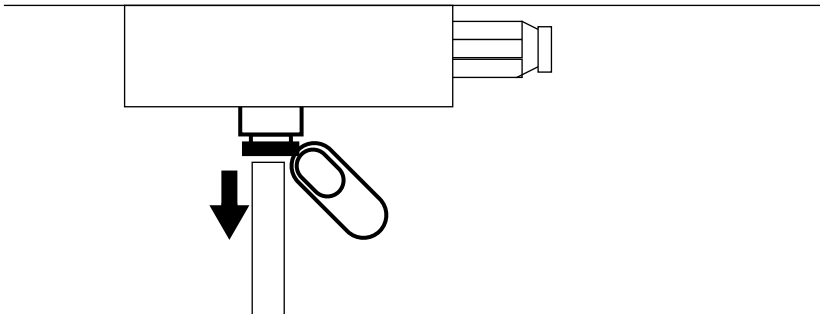
Note This replacement and test procedure is a service action and is not part of the maintenance program.

1. Set the system switch to Standby.
2. After replacing the valve cartridge assembly, remove the vaporizer port o-ring.
3. Attach the valve tester to the top of the valve by sliding the bottom of the tester onto the o-ring groove.
4. Tighten the tester screw down onto the valve until the screw bottoms out on the top of the valve. The tester o-ring should create a seal with the top of the valve.
5. Remove the upper rear panel (Section 4.3).
6. Remove the inlet tube from the vaporizer manifold.
7. Set the SCGO Selector switch to ACGO.
8. Test the negative low-pressure leak-test device:
   a. Put you hand on the inlet of the leak-test device. Push hard for a good seal.
   b. Remove all air from the bulb.
   c. The bulb should not inflate in less than 60 seconds.
9. Attach the negative low-pressure leak-test device to the ACGO outlet.
10. Remove all air from the bulb. The bulb should not inflate in less than 45 seconds.
11. Remove the valve tester.
12. Reassemble the inlet tube, vaporizer port o-ring, and the upper rear panel.
13. Conduct a negative low-pressure leak test on the system (Section 3.5.1).

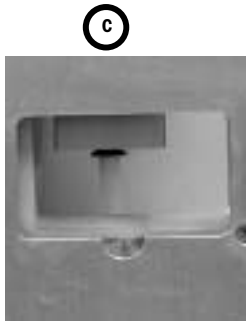
⚠ **WARNING** If the valve test tool is not removed before flowing gas through the system, pneumatic head damage could result.

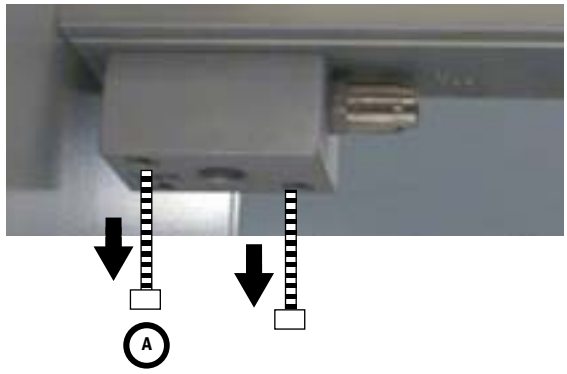
4.10.3 Replace vaporizer manifold check valve

1. Set the system switch to Standby.
2. Remove the vaporizers from the vaporizer manifold.
3. Remove the upper rear panel.
4. Disconnect the tubing from the valve block.



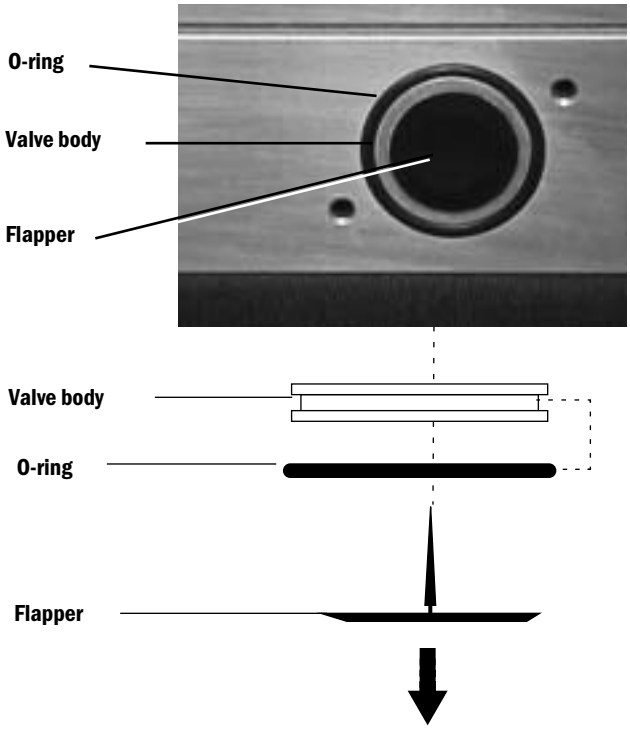
5. Remove the valve block.
   - To access the left-hand mounting screw (**A**), remove the right (viewed from front) side panel (**B**).
   - The right-side extrusion include an access hole (**C**) for removing the left-hand mounting screw.
   - **Note:** For early production machines that do not have an access hole in the extrusion, you must remove the vaporizer manifold to remove the valve block.





Note The valve body, o-ring, and flapper do not come out with the block. They stay intact at the bottom of the vaporizer manifold.

6. Pull the flapper out of the valve body.



7. Using a hex wrench, put the wrench through one of the holes of the valve body and pull down to remove the valve body and o-ring.
8. Verify that parts are free of dust and dirt.
9. Replace the flapper by inserting the flapper stem and gently pulling the stem until the flapper secures to the valve body.
10. Lightly lubricate the o-ring with Krytox.
11. Place the lubricated o-ring on the valve body port at the bottom of the manifold.
12. Gently install the valve body in the manifold:
    - Check that the o-ring makes a good seal between the manifold and the valve body.
    - Check that the flapper valve makes solid contact with the valve body.
13. Install the valve block.
14. Reconnect the tubing to the valve block. Pull on the tube to ensure that it is locked in the fitting.
15. Install the vaporizer front panel.
16. Perform the checkout procedure (Section 3).

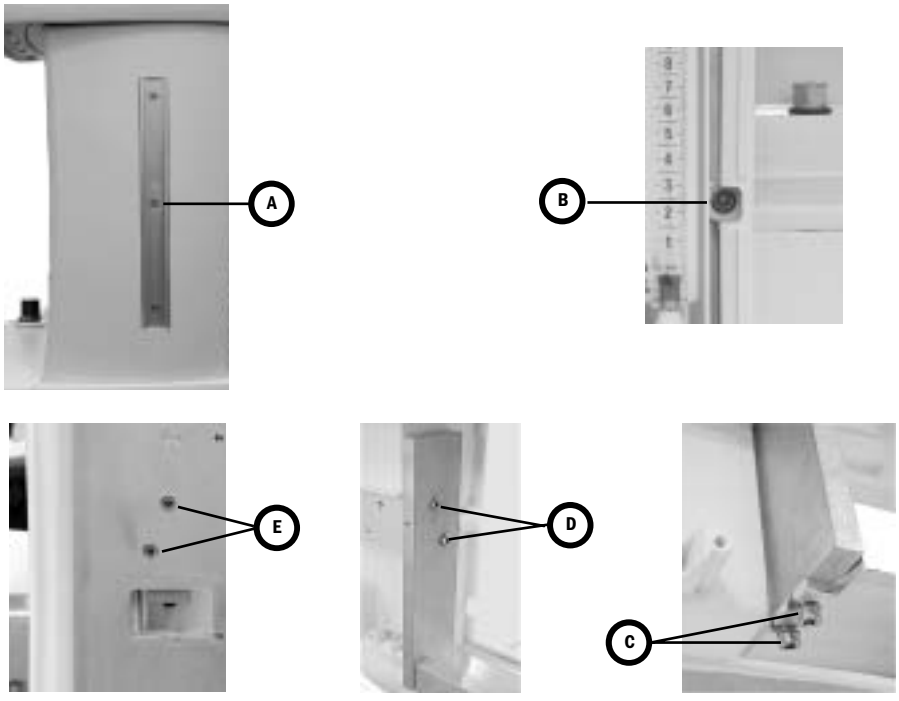
4.10.4 Replace vaporizer pressure relief valve

1. Set the system switch to Standby.
2. Remove the vaporizers from the vaporizer manifold.
3. Remove the upper rear panel (Section 4.3).
4. Using a 13mm open ended wrench, remove the vaporizer pressure relief valve by turning counterclockwise.

5. Verify that the parts are free of dust and dirt.
6. Install a new vaporizer pressure relief valve.
7. To reassemble, perform the previous steps in reverse order.
8. Perform the checkout procedure (Section 3).

4.10.5 Replace vaporizer manifold

1. Remove the upper rear panel (Section 4.3).
2. Remove the front flowmeter shield (Section 4.9.1).
3. Remove the right side panel (**A**).
4. From the front of the machine, remove the screw (**B**) at the right upright of the flowhead bezel.
5. From the back of the machine, remove the two screws (**C**) that hold the vaporizer manifold vertical support to the flowhead bracket.
6. From the back of the machine, remove the two screws (**D**) that hold the vertical support to the vaporizer manifold.
7. Remove the vertical support from the machine.
8. While holding the vaporizer manifold, remove the two screws (**E**) at the right-hand extrusion to release the manifold.

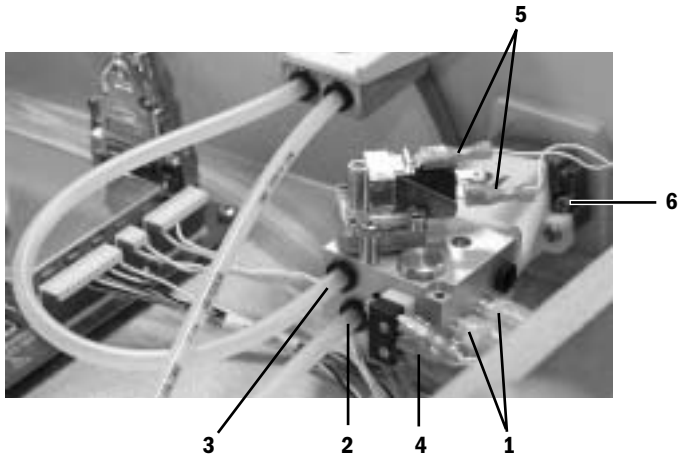


9. Install the new vaporizer manifold in reverse order. Do not fully tighten the screws until they are all in place.
   - Attach the new manifold to the right-hand extrusion (**E**).
   - Attach the vertical support to the vaporizer manifold (**D**).
   - Attach the bottom of the vertical support to the flowhead bracket (**C**).
   - Attach the vertical support to the front bezel (**B**).
10. Tighten the mounting screws in the following order: **E**, **D**, **C**, **B**.
11. Reassemble the machine.
12. Perform the checkout procedure (Section 3).

4.11 Replace ACGO selector switch

Removal

1. Remove the tabletop (Section 4.4).
2. Clip the tie wraps (**1**) from the outlet barb fittings at the side of the switch.

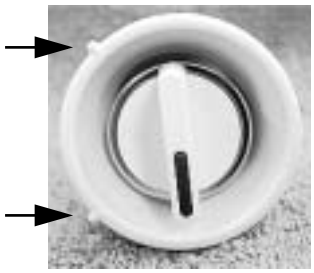


3. Disconnect the fresh gas (**2**) and flush (**3**) tubes at the back of the switch.
4. Disconnect the wires from the ACGO mode microswitch (**4**) at the back of the selector switch.
5. Disconnect the wires from the flush pressure switch (**5**) on top of the selector switch.
6. Set the ACGO selector switch to ABS.
7. Back out the selector switch mounting screws (**6**) until the tips are flush with the face of the mounting casting.
8. While pushing the selector knob toward the machine and holding it steady, push the valve body toward the knob and rotate it counterclockwise to separate the valve body from the knob assembly.
9. Remove the knob assembly and protective shroud from the machine.
10. Remove the valve from the silicone output tubes.

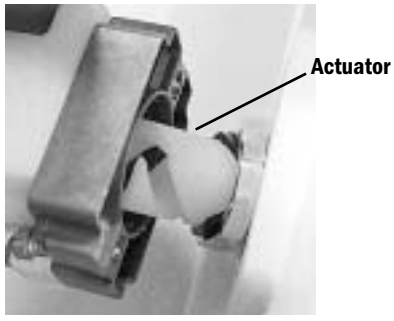
Replacement

1. Remove the knob assembly from the valve body.
2. Back out the selector switch mounting screws until the tips are flush with the face of the mounting casting.
3. Guide the outlet fittings of the valve body into their respective silicone tubes.
4. Hold the selector knob with the indicator mark facing down. Turn the chrome collar to its maximum counterclockwise position (as viewed from the front).

5. Place the shroud over the knob and guide the assembly into the pan opening.
6. Ensure that the indicators on the shroud align with label on the pan and the alignment tab mates with the alignment hole in the pan.



7. While holding the knob assembly steady against the pan, place the valve assembly over the knob actuator. Using moderate force press the two assemblies together. The knob should rotate to the ACGO position.



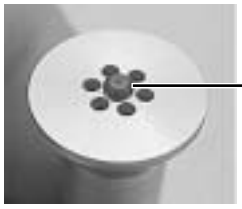
8. While continuing to force the assemblies together, rotate the knob assembly to the ABS position. The assemblies should snap into place.
9. Verify proper alignment of the knob with the setting indicators. Tighten the mounting screws evenly to secure the switch assembly to the pan.
10. Secure the outlet tubing with tie wraps.
11. Connect the fresh gas and flush gas tubing. Pull on the tubing to ensure that it is locked in the fitting.
12. Reconnect the wires to the ACGO mode microswitch at the back of the valve (top two terminals).
13. Reconnect the wires to the flush pressure switch at the top of the valve (upper and lower terminals).
14. Replace the tabletop.

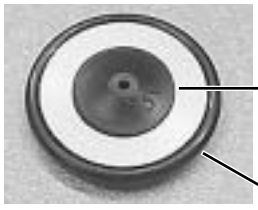
Test procedure

1. Confirm that flush flow and 5 L/min fresh gas flow are diverted to the ACGO port and the ABS in the respective knob positions.
2. Confirm that the ventilator display indicates ACGO mode when the valve is set in the ACGO position.
3. Test the function of the flush pressure switch (Service Mode - “Display Discrete I/O Signals”).
4. Perform the low-pressure leak test (Section 3.5).
5. Perform the checkout procedure (Section 3)

4.12 Clean or replace ACGO port flapper valve

1. Remove the tabletop (Section 4.4).
2. Remove the ACGO cap mounting screws.
3. Remove the cap.
4. Examine the flapper and disk for obstructions or debris. Clean with isopropyl alcohol if necessary; retest.
5. If leak persists, replace the flapper.
   - Remove the flapper from the check valve disk.
   - Clean the new flapper with isopropyl alcohol.
   - Apply a drop of isopropyl alcohol to the center hub of the new flapper.
   - Before the alcohol evaporates, align the center hub of the new flapper with the center hole of the check valve disc.
   - While pressing the flapper against the disc, use you fingernail to help pull the hub through the disc from the other side.





6. Lubricate the o-ring sparingly with Krytox (do not get Krytox on the flapper).
7. Insert the flapper assembly into the ACGO outlet with the flapper up.
8. Replace the cap.

4.13 Reconfigure sample gas return line

Sample gas return is directed to the scavenging system as a factory default. Perform the following to reroute the sample gas back to the breathing system. Refer to “Tubing” on page 9-8.

1. Remove the tabletop (Section 4.4).
2. Port 4 (**A**) of the ABS breathing system is connected to the expiratory circuit, downstream of the expiratory check valve. As a factory default, Port 4 is plumbed with a length of tubing that is plugged (**B**) at the far end.

3. Remove the plug from the tube.
4. Find the sample return line at the left-rear corner of the pan assembly. The sample return line includes an inline connector (**C**) at the point where the sample line goes down into the vent engine housing.

5. Separate the scavenging tube, removing the inline connector from the portion of the tube that extends into the vent engine housing. Plug the open end of the scavenging tube with the plug removed above.
6. Insert the inline connector from the sample return port into the open tube to Port 4. Pull on the connector to ensure that it is securely connected.
7. Replace the tabletop.
8. Perform the checkout procedure (Section 3).

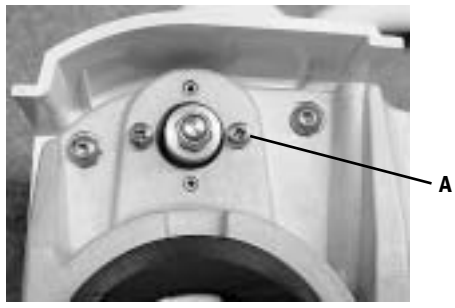
4.14 Replace the APL valve

1. Remove the ABS breathing system.
2. The APL valve is held in place with a spring and a retainer (**A**) that snaps into a recess in the lower body of the APL valve. To release the retainer, place an appropriately sized straight blade screwdriver into the housing cutout (**B**). Twist the screwdriver to release the retainer.

3. Place the new APL valve into position with the setting indicator facing forward.
4. Place the spring into the retainer.
5. While holding the APL valve tight to the housing, Snap the spring and retainer onto the valve body from below.
6. Reinstall the ABS breathing system.
7. Perform the checkout procedure (Section 3).

4.15 Replace the bag support arm

1. Remove the ABS breathing system from the machine.
2. From the underside of the casting, remove the two screws/ lockwashers (**A**) that hold the arm in place.



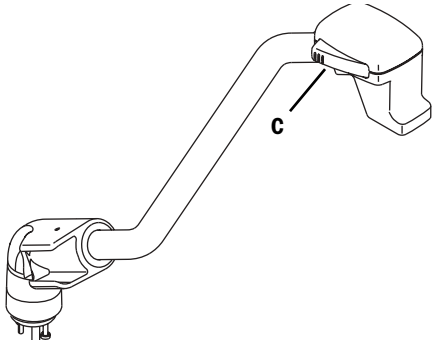
   - If either of the pins (see below) remain in the casting, remove them from the casting.

3. Install the new bag support arm assembly.

   - Position the bag arm over mounting pattern of 4 small holes in the support casting. The arm should extend towards the front of the machine. Align the two pins (**B**) extending from the base of the bag arm assembly, with two of the small holes in the casting that are in line with the APL valve.
   - Lower the bag arm, pushing the two pins into the holes.
   - From the underside of the casting, secure the bag arm with two M3x16 screws and lockwashers.
4. Test the force required to swing the bag arm from side to side and adjust if necessary.

Note: The adjustment nut is initially set so that 5-mm of exposed thread extends from the adjusting nut. With use, the force required to move the arm increases and may require readjustment.

The force is adjusted by turning the lock nut (8-mm socket) which is accessible from underneath the support casting. Turn clockwise to increase the force and counterclockwise to reduce the force.



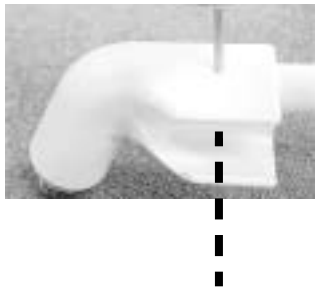
   - Swing the bag arm sideways through the 90 degree arc permitted by its internal stop.
   - Adjust to just enough friction to prevent the bag arm from swinging sideways as the bag height is being changed. The bag arm height is changed by squeezing the lock release lever (**C**) at the free end of the bag arm and rotating it to the desired position.
5. Replace the ABS breathing system.

4.15.1 Servicing the bag support arm

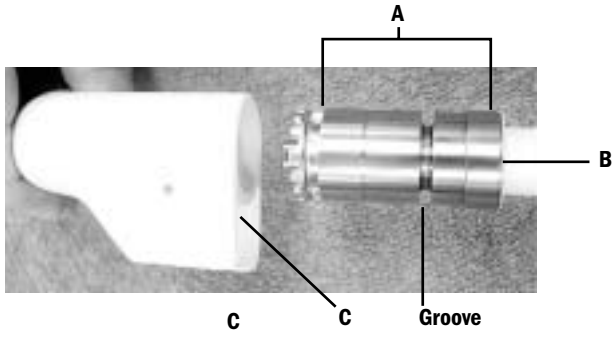
Service parts for the bag support arm include the upper and lower assemblies.

To replace either assembly:

1. Remove the bag support arm from the machine (Section 4.15).
2. To separate the upper assembly from the lower assembly, use a small (2.5-mm) pin punch from the bottom to drive the dowel pin up and out.



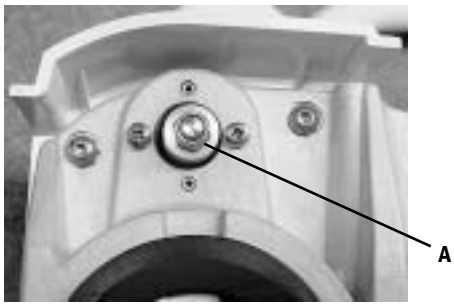
3. To assemble the bag arm, apply a light coat of Krytox to the area of the upper arm (**A**) that extends into the lower arm (including the dowel pin groove).



4. Insert the upper assembly into the lower assembly. Align the surface (**B**) of the upper assembly with the surface (**C**) of the lower assembly.
5. Insert the dowel pin into the hole (from the top side as shown). Drive the dowel pin into the bag arm until it is flush with the top surface.

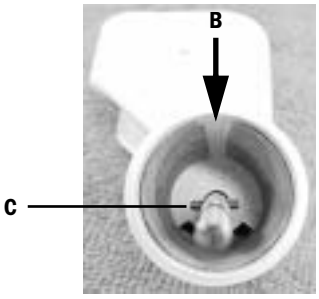
4.15.2 Replace friction pad in lower bag arm assembly

1. Remove the ABS breathing system from the machine.
2. Using an 8-mm socket, remove the nut (**A**), shoulder washer, and spring from the lower assembly.

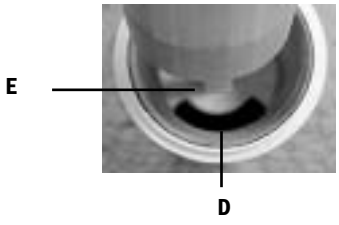


3. Lift the bag support arm off of the swivel post. Remove the old friction pad.
4. Wipe any residue and friction particles from the post.
5. Insert a new friction pad into the base. Keep approximately 1 mm of space between the end of the pad and the bottom of the base.

   Note: Align the friction pad gap with the seam (**B**) in the base. Position the retaining screw so the pin (**C**) at the base is perpendicular to the seam.



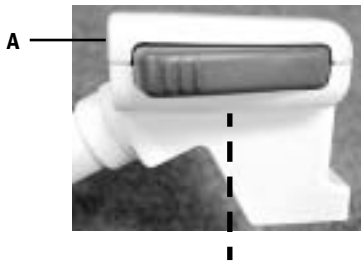
6. With the bag support arm facing forward, place the base of the arm over the swivel post. Ensure that the slot in the base (**D**) engages the tab (**E**) on the swivel post.
7. Replace the spring, shoulder washer and nut. Tighten the nut until 5 mm of thread extends beyond the nut.



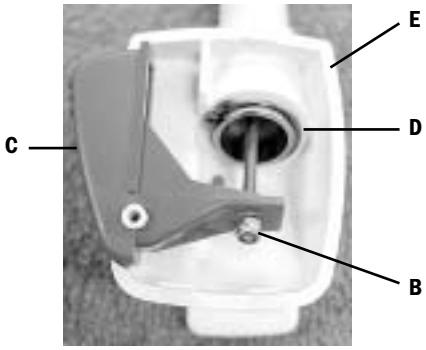
8. Follow the procedure in Section 4.15 to adjust the force required to swing the bag arm from side to side.

4.15.3 Replace bag port housing

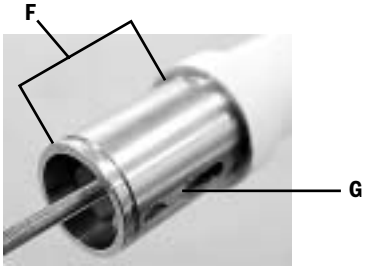
1. Remove the bag support arm cover (**A**) — screw and lockwasher from below.



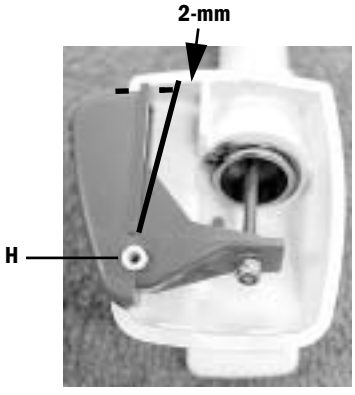
2. Remove nut (**B**) to remove the release lever (**C**).
3. Remove the retaining ring (**D**).
4. Slide the bag port housing (**E**) off the end of the bag support arm.



5. Before installing the new bag port housing, clean and lubricate sparingly with Krytox the exposed metal end (**F**) and the guide slot (**G**) of the bag support arm.

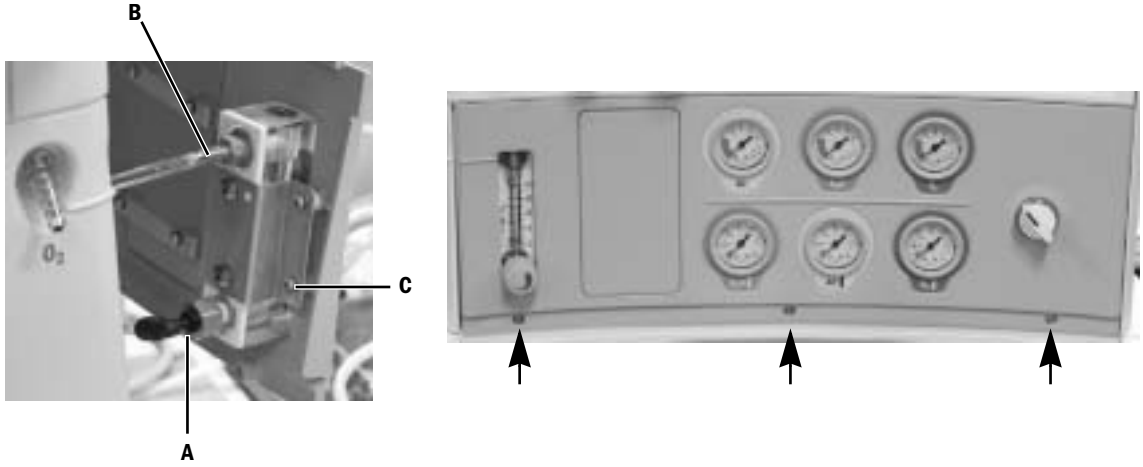


6. Slide the new bag port housing onto the bag arm. Secure it with the retaining ring.
7. Lubricate sparingly with Krytox the pivot boss (H) before replacing the release lever.
8. After replacing the release lever, adjust the mounting nut so that a 2-mm gap remains between the lever and housing when the release lever is fully depressed.
9. Replace the bag arm cover.



4.16 Replace auxiliary O_2 flowmeter

1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Remove the tabletop (Section 4.4).
4. Remove the adjustment knob from the flowmeter; pull forward.
5. Remove the gauge panel mounting screws and move the panel forward to access the flowmeter.



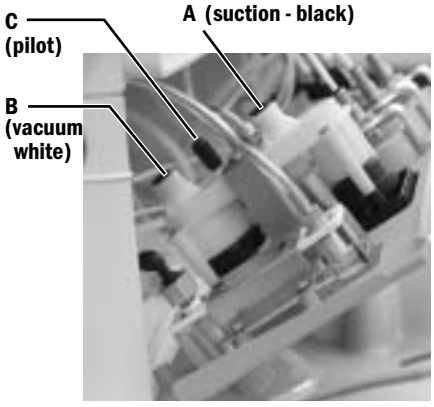
6. Disconnect the inlet tube fitting (A).
7. Disconnect the tube (B) from the outlet fitting.
8. Remove the four screws (C) that hold the flowmeter mounting bracket to the front panel.
9. Transfer the mounting bracket to the new flowmeter.
10. Reassemble in reverse order.
11. Perform the checkout procedure (Section 3).

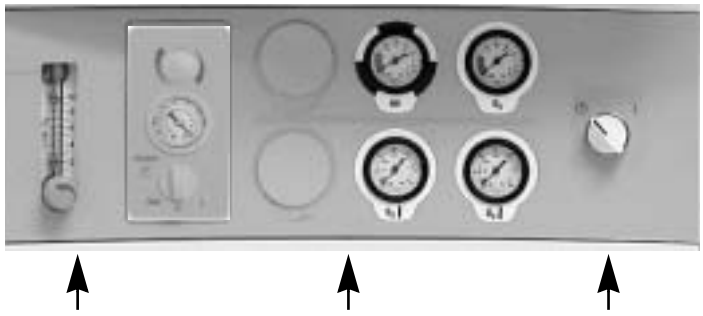
4.17 Replace the suction control module

The suction control module can be replaced by removing the front panel, along with the ABS and the tabletop, to gain access. Alternatively, if the situation warrants, the suction control module can be accessed by removing the rear panel.

4.17.1 Front panel method

1. Bleed all gas pressure from the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Remove the tabletop (Section 4.4).
4. Remove the gauge panel mounting screws and move the panel forward to access the suction control module.

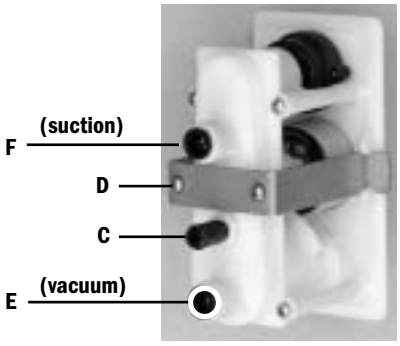


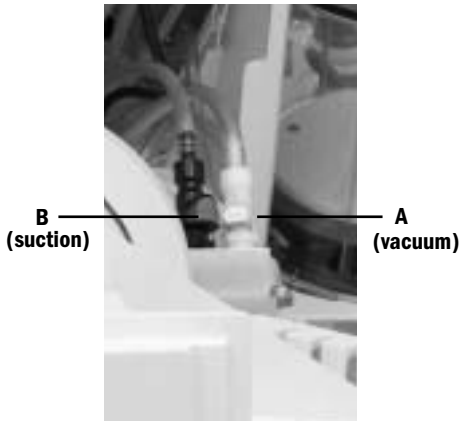


5. Disconnect the tubing from the suction control module.
   - Tube (**A**) from overflow safety trap (suction).
   - Tube (**B**) from vacuum source.
   - If venturi drive, tube (**C**) from pilot valve adapter.
6. Remove the two mounting screws that hold the suction control module to the mounting bracket.
7. Transfer the mounting bracket to the new suction control module.
8. Reassemble in reverse order.
9. Perform the checkout procedure (Section 3).

4.17.2 Rear panel method

1. Lower the upper rear panel (Section 4.3).
2. Disconnect the white (**A**) vacuum and black (**B**) suction fittings from the rear panel. Do not remove the tubing from the regulator.
3. If you are replacing a venturi drive suction control module, disconnect the tube (**C**) from the pilot valve adapter.



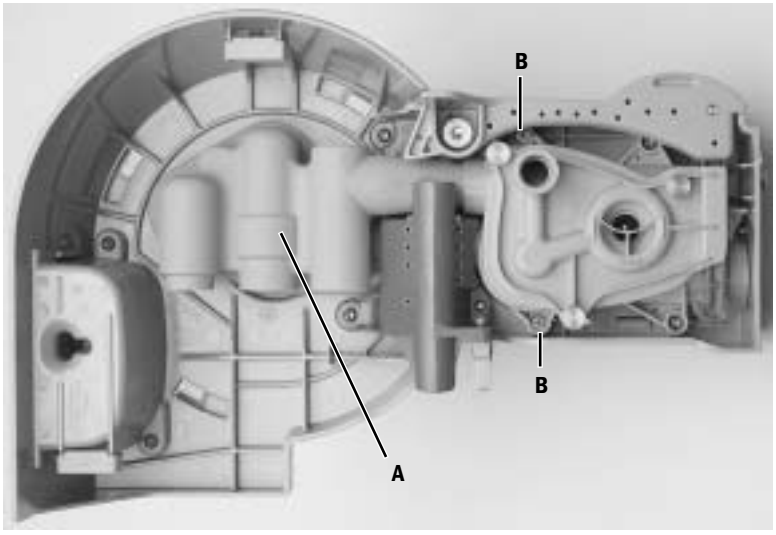


4. Remove the two screws (**D**) that hold the suction control module to the mounting bracket.
5. Remove the regulator assembly from the front panel.
6. Transfer the tubing to the new regulator:
   - Attach the vacuum source tube (white fitting) to the lower connector (**E**).
   - Attach the suction tube (black fitting) to the upper connector (**F**).
7. Guide the tubes into the front panel opening.
8. While holding the regulator assembly against the front panel, attach the retaining bracket to the regulator. Tighten the screws to secure the regulator assembly.
9. If applicable, attach the control port tube to the pilot valve adapter (**C**).
10. Attach the vacuum and suction fitting to the rear panel manifold.
11. Replace the rear panel.
12. Perform the checkout procedure (Section 3).

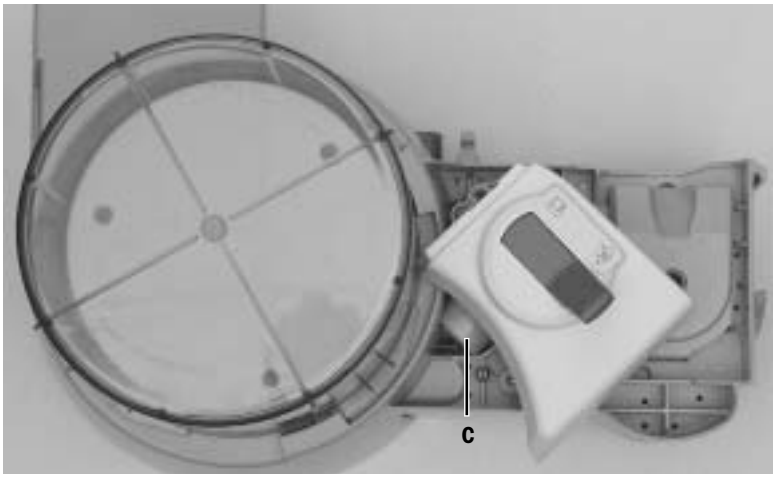
4.18 Replace ABS breathing system components

4.18.1 Replace Bag/Vent switch assembly

1. Remove the ABS breathing system.
2. From the underside, remove the bellows base manifold (**A**) and fully loosen the two captive screws (**B**) at the bag port side of the APL/BTV manifold.



3. From the topside, rotate the Bag/Vent switch cartridge counterclockwise until the Bag/vent switch outlet port (**C**) clears the bellows housing.

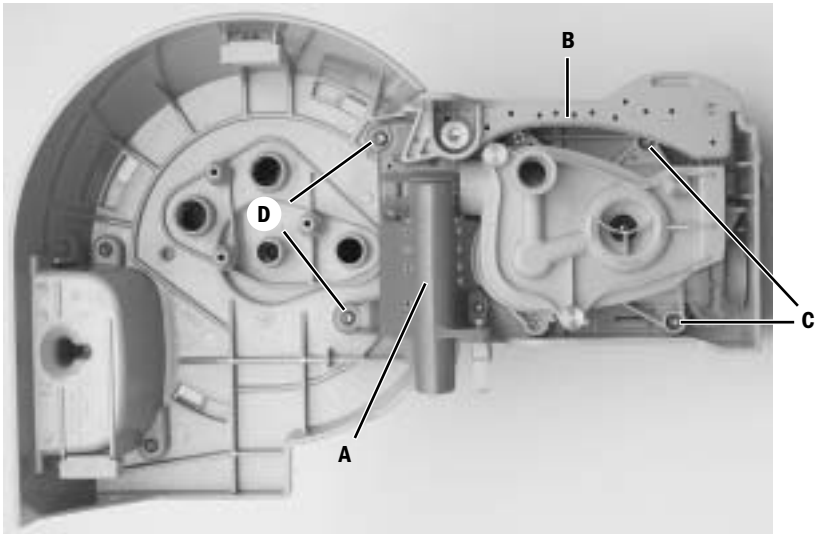


4. Lift out the Bag/Vent switch cartridge from the housing.
5. Replace the Bag/Vent switch cartridge in reverse order.
6. Reinstall the ABS breathing system.
7. Perform the checkout procedure (Section 3).

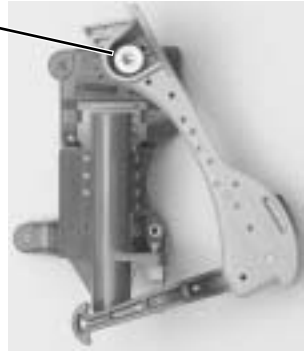
4.18.2 Replace bellows base latch assembly

To replace the latch assembly, you must disassemble the bellows base assembly to the point where you can remove the guide (**A**) and latch assembly (**B**) as a unit.

1. Remove the Bag/Vent switch cartridge (Section 4.18.1).
2. Remove the two remaining screws (**C**) that hold the APL/BTV manifold to the bellows base assembly. Remove the APL/BTV manifol.



3. To remove the guide/latch assembly, remove two mounting screws (**D**) from the underside. Remove two additional mounting screws from the topside. Remove the guide/latch assembly from the bellows base assembly.
4. Separate the latch assembly from the guide assembly.
5. To install the new latch assembly, put the spring (**E**) into place in the guide assembly (long leg down).
6. Place the latch assembly on the guide assembly so that the latch engages the short leg of the spring. Secure the latch assembly (**F**) to the guide assembly.



7. Mount the guide/latch assembly into the bellows base assembly.
8. Reassemble the breathing system in reverse order.
9. Perform the checkout procedure (Section 3).

4.19 Replace casters

⚠ **WARNING** Replacing a caster requires at least two people to maneuver and tip the machine. Personal injury and/or machine damage is possible if one person attempts this procedure alone.

1. Disconnect all pipeline hoses from the wall and the machine, close all gas cylinders, unplug the power cord, and set the system switch to standby.

⚠ **CAUTION** Remove the vaporizers before tipping the machine. If a vaporizer is inverted, it must be set to 5% and purged for 30 minutes with a 5 L/min flow. The interlock system prevents purging more than one vaporizer at a time.

2. Remove the absorber, the vaporizers, gas cylinders, drawers and all auxiliary equipment.

⚠ **CAUTION** To prevent damage, do not tip the Aespire machine more than 10 degrees from vertical.

3. Block the opposite wheels; then, block up the machine until there is enough room to remove the defective caster.

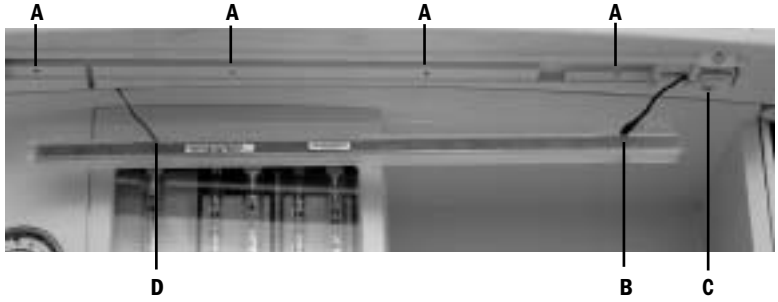
   To block up the machine, tip and slide blocks under the caster base. Raise both sides evenly until the unit is high enough to remove the caster.

4. The casters are threaded into the base and held with a Loctite compound. Remove the caster with an appropriately sized open-end wrench.

5. If required, clean the treads of the new caster with denatured alcohol.
6. Apply Loctite 242 to the threads of the new caster. Install the caster securely into place.
7. Make sure the caster turns freely.
8. Carefully lower the machine to the floor.
9. Perform the checkout procedure (Section 3).

4.20 Replace task light and switch

Remove the four screws (**A**) that hold the task-light lens to the upper shelf.



4.20.1 To replace the task-light switch

1. Using a small needle-nose pliers, disconnect the switch harness from the task-light circuit board connector (**B**).
2. Remove the two screws (**C**) that hold the switch retainer plate to the upper shelf.
3. Transfer the switch retainer plate to the new switch, counter-sunk side to the outside.
4. Mount the switch to the upper shelf.
5. Remount the task-light assembly. Ensure that the switch harness and the task-light harness wires are positioned in their respective recesses and are not pinched under the task-light lens.

4.20.2 To replace the task-light circuit board

1. Using a small needle-nose pliers,
   - disconnect the switch harness from the task light circuit board connector (**B**).
   - disconnect the task-light harness from the task light circuit board connector (**D**).
2. Slide the task-light circuit board out of the lens.
3. Slide the new task light into the lens, ensuring that the connectors are aligned with the lens cutouts.
4. Plug the task-light harness and the switch harness into their respective connectors on the task-light circuit board. Use a small screwdriver to push the connectors securely into place.
5. Remount the task-light assembly. Ensure that the switch harness and the task-light harness wires are positioned in their respective recesses and are not pinched under the task-light lens.

4.21 Replace the display arm or display cables

Cable replacement requires that you first remove the display arm from the dovetail extrusion.

Before replacing the display arm, note the routing of the cables.

After replacing the display arm, ensure that the cables are dressed properly and do not interfere with the motion of the display arm.

Follow the procedure in Section 4.21.1 for the recommended use of cable ties.

4.21.1 Cable tie installation

1. Wrap the cable tie around the cables in the indicated position. Start the tail through the clamp as shown.

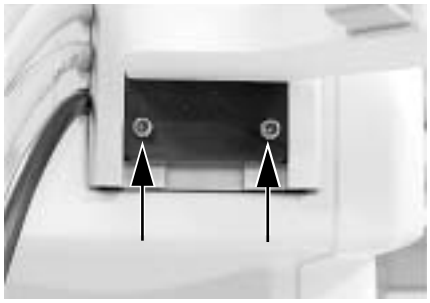
2. Feed the tail between the cables.

3. Pull the tie tight and cut off the tail below the outer surface of the cables. Do not leave a sharp edge exposed.

4.21.2 Removing the display arm

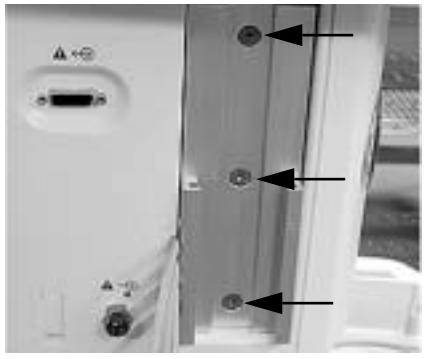
If equipped, remove additional equipment from the arm before removing the arm.

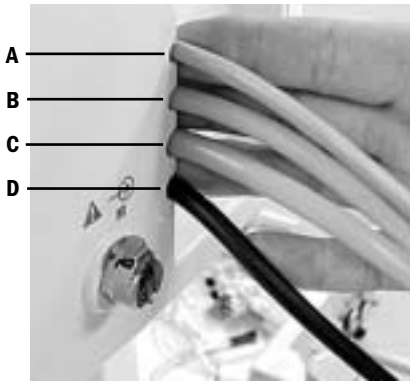
1. Disconnect the cables from the display.
2. Remove the display from the display arm.
3. Remove the cables from the cable clamps.
4. Loosen the screws that secure the display arm in the dovetail.
5. If required, use a rubber mallet to tap the display arm out of the dovetail.



4.21.3 Replacing a display cable

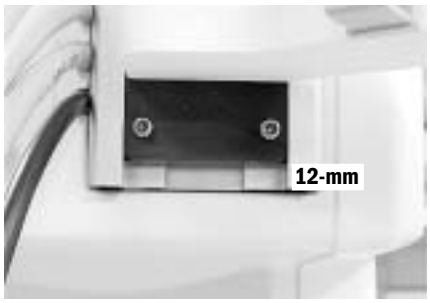
1. Remove the three screws that hold the dovetail extrusion to the upright. Remove the extrusion to allow cable replacement.
2. As require to access the particular cable routing for replacement, remove either (or all):
   - the rear cover (Section 4.3),
   - the tabletop (Section 4.4),
   - or the AC Inlet module.
3. After replacing the cable, place the cables in the notches in the order shown.
   - A - Serial Isolation
   - B - Monitoring
   - C - Vent Engine
   - D - Power cable
4. Install the dovetail extrusion loosely to hold the cables in place.
5. Adjust the cable length outside the machine to approximately 66 cm.
6. Securely tighten the extrusion mounting screws.

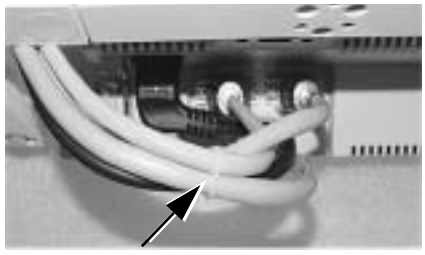




4.21.4 Installing the long arm

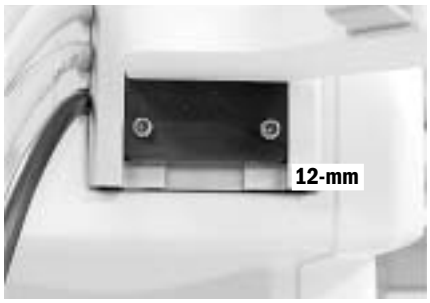
1. Place the arm into the extrusion.
2. Use a rubber mallet to tap the arm into place. Leave a 12-mm gap between the lower edge of the arm mounting plate and the end of the dovetail.
3. Tighten the mounting screws to secure the display arm.
4. Remount the display.
5. Route the display cables neatly through the cable clamps.
6. Attach the cables to the display.
7. If required, install cable tie in the locations shown.
   - Place one cable tie close to the pivot of the arm.
   - Place the second cable tie near the display as shown.
8. Ensure that the cables are secured so that they do not interfere with the display arm through the entire range of motion.



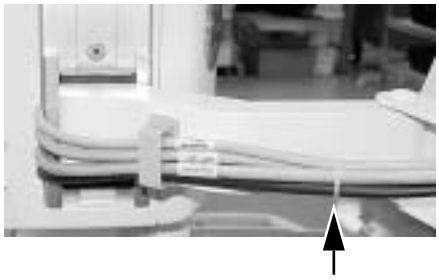


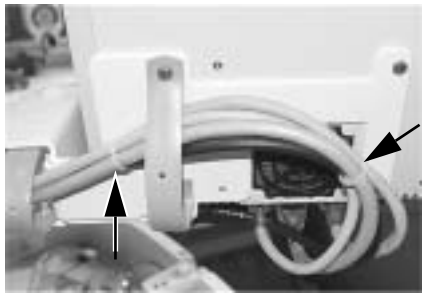
4.21.5 Installing the short arm

1. Place the arm into the extrusion.
2. Use a rubber mallet to tap the arm into place. Leave a 12-mm gap between the lower edge of the arm mounting plate and the end of the dovetail.



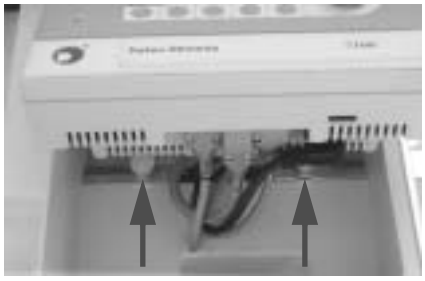
3. Tighten the mounting screws to secure the display arm.
4. Remount the display.
5. Route the display cables neatly through the cable clamps.
6. Attach the cables to the display.
7. If required, install cable tie in the locations shown.
   - Place one cable tie close to the pivot of the arm.
   - Place the second cable between the two straps.
   - Place the third cable tie near the display as shown.



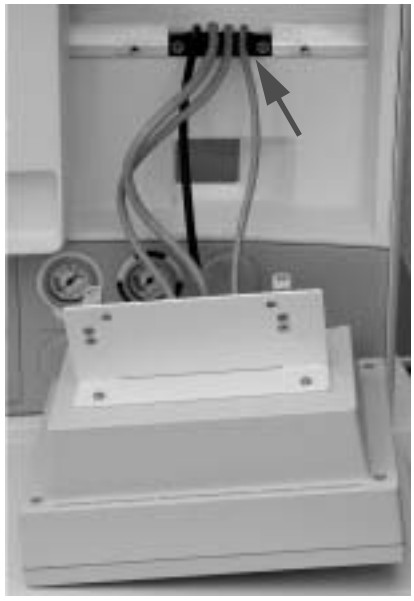


8. Ensure that the cables are secured so that they do not interfere with display through the entire range of motion.

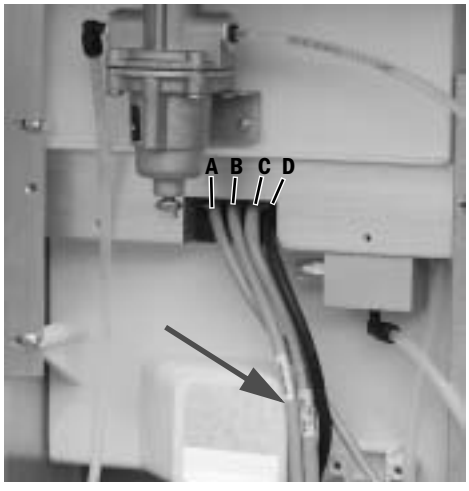
4.22 Replace display and cables in ProTIVA machine

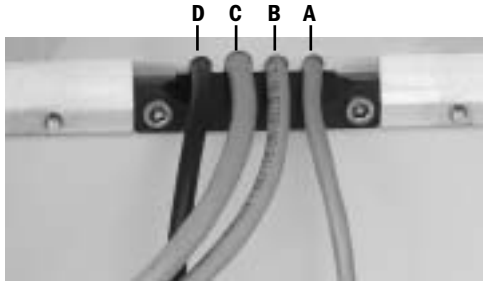


1. Remove two thumbscrews that secure the display mounting bracket to the no-vap manifold.
2. Lift the display slightly to disengage the mounting pins.
3. Lower the display face down on the worksurface.
4. Replace the display and reassemble in reverse order.



5. **To replace a cable**, remove the retaining block and feed the cable to the back of the machine.
6. As require to access the particular cable routing for replacement, remove either (or all):
   - the rear cover (Section 4.3),
   - the tabletop (Section 4.4),
   - or the AC Inlet module.
7. Attach the cable to the display.
8. When replacing the cable retainer, ensure:
   - that the cables fit properly in their feed-through slots (as detailed below),
   - and that they extend out of the machine with minimal slack.
9. From the back of the machine, ensure that the cables are routed such that they do not interfere with the replacement of the rear cover.





A - Serial Isolation

B - Monitoring board

C - Vent Engine

D - Power cable

5 Maintenance

In this section

This section covers the regular maintenance procedures (minimum requirements) needed to make sure that the Aespire Anesthesia Machine — including the ventilator — operates to specifications.

5.1 Aespire Planned Maintenance 5-2

5.1.1 Every twelve (12) months 5-2

5.1.2 Every twenty-four (24) months 5-3

5.2 Auxiliary O_2 flowmeter tests 5-4

5.3 Integrated Suction Regulator tests 5-5

⚠ **WARNINGS**

Do not perform testing or maintenance on the Aespire Anesthesia Machine while it is being used on a patient. Possible injury can result.

Items can be contaminated due to infectious patients. Wear sterile rubber gloves. Contamination can spread to you and others.

Obey infection control and safety procedures. Used equipment may contain blood and body fluids.

5.1 Aespire Planned Maintenance

Serial Number:	Date: (YY/MM/DD) / /
Hospital:	Performed by:
☐ 12 months ☐ 24 month	☐ _____

5.1.1 Every twelve (12) months

Perform the following steps every 12 months.

Machine Parts Replacement

Refer to the listed section in this manual. Perform the following step:

☐ Replace the vaporizer port o-rings (*Section 4.10.1*)
(Kit Stock Number 1102-3016-000)

Machine Checks and Tests

Refer to the Aespire User's Reference Manual, Part 2.
Perform the following steps:

☐ 1. User maintenance listed below. Including disassembly, inspection, cleaning and parts replacement as required (*Section 3 and Section 2*).

- AGSS Maintenance:
  Empty any condensate from the reservoir (disposable item).
  Inspect air brake for occlusion.
  Inspect, clean or replace filter on active AGSS.
- Breathing Circuit Maintenance
- Bellows Assembly Maintenance
- Bellows Assembly Tests
- O_2 Sensor Calibration
- Flow Sensor Calibration

Refer to listed sections in this manual.
Perform the following steps:

☐ 2. Inspect the system (*Section 3.1*)

☐ 3. Pipeline and cylinder tests (*Section 3.2*)

☐ 4. Flow control and pressure relief tests (*Section 3.3*)

☐ 5. Vaporizer back pressure test (*Section 3.4*)

☐ 6. Low-pressure leak test (*Section 3.5*)

☐ 7. Airway pressure gauge accuracy check (*Section 6.6.2*)

☐ 8. Alarm tests (*Section 3.6*)

☐ 9. Breathing systems tests (*Section 3.7*)

☐ 10. Auxiliary O_2 flowmeter tests, if equipped with option (*Section 5.2*)

- ☐ 11. Integrated suction regulator tests, if equipped with option (*Section 5.3*)
- ☐ 12. Power failure test (*Section 3.10*)
- ☐ 13. Electrical safety tests (*Section 3.11*)

7100 Ventilator Checks, Tests and Calibrations

Refer to the listed sections in the Aestiva 7100 Ventilator Service Manual. Perform the following steps:

- ☐ 1. MOPV pressure relief valve test (Section 6.3)
- ☐ 2. From the Ventilator Service Mode menu, perform the following:
  - Display Discrete I/O Signals. Verify proper operation of all switches. (*Section 4.10.2*)
  - Display Error Log. If any error codes have been logged follow the appropriate troubleshooting procedures. Clear the error log. (*Section 4.5*)
  - Adjust Drive Gas Regulator (*Section 4.9.3*)
  - Airway Sensor Span (*Section 4.9.4*)
  - PEEP Valve Calibration (*Section 4.9.5*)
  - Inspiratory Valve Calibration (*Section 4.9.6*)
  - Pressure Sensitivity (*Section 4.9.7*)

5.1.2 Every twenty-four (24) months

In addition to the 12-month requirements, replace the following parts every 24 months. All machine and ventilator parts should be replaced before performing the checks, tests, and calibrations.

7100 Ventilator Parts Replacement

Refer to the listed sections in the Aestiva 7100 Ventilator Service Manual. Perform the following steps:

- ☐ 1. Replace the internal backup battery (*Section 7.2.3*) (Stock Number 1504-3505-000).
- ☐ 2. Replace the free breathing flapper valve (*Section 6.2*) (Stock Number 0211-1454-100).
- ☐ 3. Replace the free breathing valve o-ring (*Section 6.2*) (Stock Number 1503-3208-000).

5.2 Auxiliary O_2 flowmeter tests

1. Open the O_2 cylinder valve or connect an O_2 pipeline.
2. Rotate the flow control clockwise (decrease) to shut off the flow. The ball should rest at the bottom of the flow tube and not move.
3. Rotate the flow control counterclockwise (increase). The ball should rise immediately after rotation is begun. It should rise smoothly and steadily with continued counterclockwise rotation. When a desired flow is set, the ball should maintain in a steady position.
4. Rotate the flow control clockwise to shut off the flow.

Flow Accuracy Test

Note: To check flow accuracy, be sure that the flow test device is capable of measuring 0 to 15 L/min with an accuracy of ±2% of reading.

1. Connect the flowmeter outlet to the flow test device.
2. Adjust the flowmeter so the **center** of the ball aligns with the selected test point (observe that the ball maintains a steady position for 10 seconds).
3. The test device reading should be between the limits shown for each of the selected settings in the table below.

	Flow Tester Reading	
Flowmeter Setting L/min	**Lower Limit L/min**	**Upper Limit L/min**
1	0.52	1.48
3	2.56	3.44
5	4.60	5.40
10	9.70	10.30
maximum (valve fully open)	12.00	-------

4. Rotate the flow control clockwise to shut off the flow.
5. Close the O_2 cylinder valve or disconnect the O_2 pipeline.

5.3 Integrated Suction Regulator tests

Note There are two types of integrated suction systems for the Avance anesthesia machine:

- Continuous Vacuum Regulator, Three-Mode, Pipeline Vacuum
- Continuous Vacuum Regulator, Three-Mode, Venturi Derived Vacuum

For Pipeline Vacuum systems,
a vacuum source of at least 500 mm Hg (67 kPa or 20 in Hg) is required for testing. The supply open flow must be a minimum of 50 L/min.

For Venturi Derived Vacuum systems,
an O_2 or Air source of at least 282 kPa (41 psi) is required for testing.

Gauge Accuracy The gauge needle should come to rest within the zero range bracket when no suction is being supplied. Gauges which do not comply may be out of tolerance.

Note To check gauge accuracy, be sure that the test gauge is capable of measuring 0 to 550 mm Hg with an accuracy of ±1% of reading.

1. Connect the suction patient port to the test gauge.
2. Turn the mode selector switch to I (ON).
3. Ensure that the vacuum test gauge is in agreement with the suction vacuum gauge ± 38 mm Hg/5 kPa at the following test points.

Test points

Suction vacuum gauge	Test gauge tolerance
100 mm Hg (13.3 kPa)	62–138 mm Hg (8.3–18.4 kPa)
300 mm Hg (40 kPa)	262–338 mm Hg (35–45 kPa)
500 mm Hg (66.7 kPa)	462-538 mm Hg (61.6–71.7) kPa)

Flow Test **Note:** To check flow accuracy, be sure that the flow test device is capable of measuring 0–30 L/min.

1. Connect the patient port of the suction regulator to the flow test device.
2. Rotate the suction control knob fully clockwise (increase).
3. Turn the mode selector switch to I (ON) and verify that the flow rate is:
   - at least 20 L/min.
4. Disconnect the test flowmeter.

(Tests continue on next page.)

Regulation Test

1. Turn the mode selector switch to I (ON).
2. Occlude the patient port of the suction regulator.
3. Set the vacuum regulator gauge to 100 mm Hg/13 kPa.
4. Open and close the patient port several times.
5. With the patient port occluded, the gauge should return to 100 mm Hg/13 kPa within a tolerance of ± 10 mm Hg/1.3 kPa.

Vacuum Bleed Test

1. Occlude the patient port of the suction regulator.
2. Set the vacuum regulator gauge to 100 mm Hg/13 kPa.
3. Turn the mode selector switch to O (OFF) and observe the gauge needle. It must return to the zero range bracket or stop pin within 10 seconds.

Vacuum Leak Test

1. Turn the mode selector switch to O (OFF).
2. Rotate the suction control knob a minimum of two full turns in the clockwise direction (increase suction) to ensure its setting is not at the off position.
3. Occlude the patient port of the suction regulator.
4. Observe the suction gauge, the needle should not move.
5. Rotate the suction control knob fully counterclockwise to ensure its setting is at the fully off position.
6. Turn the mode selector switch to I (ON).
7. Observe the suction gauge, the needle should not move.

6 Calibration

⚠ WARNING After adjustments and calibration are completed, always perform the checkout procedure. Refer to Section 3 of this manual.

In this section This section covers calibration procedures for components of the Aespire anesthesia machine.

6.1 Primary Regulators 6-2

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6.1 Primary Regulators

Follow the procedure in Section 6.1.1 to gain access to the regulators. Then, in Section 6.1.2, select the test that is appropriate for the regulator you are testing.

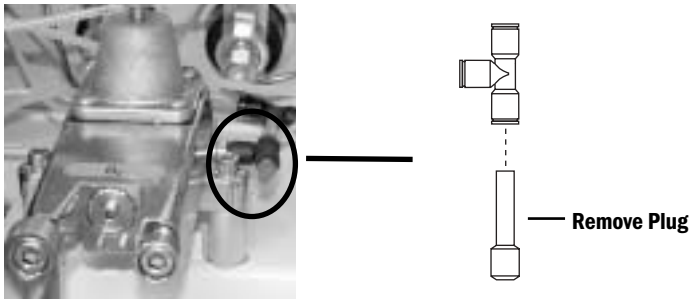
⚠ WARNING When testing/adjusting N_2O regulators, nitrous oxide flows through the system. Use a safe and approved procedure to collect and remove it.

6.1.1 Test setup

⚠ WARNING Wear safety glasses while test device is connected to the test port.

⚠ CAUTION Be careful not to plug the output of the primary regulator without having a pressure relief valve in the output circuit.

1. Set the system switch to Standby.
2. Disconnect all pipeline supplies.
3. Remove the upper rear panel (Section 4.3).
   For 3rd gas cylinder regulators, also remove the lower rear panel.
4. If equipped, turn the auxiliary O_2 flowmeter control fully clockwise (no flow).
5. Install a full cylinder in the cylinder supply to be tested. It is essential that the cylinder be within 10% of its full pressure.
6. Remove the plug from the test port and connect a test device capable of measuring 689 kPa (100 psi).



6.1.2 Testing Primary Regulators

There are two variations of the test procedure for the primary regulators:

- Test A — For primary regulators that supply drive gas to the ventilator.
- Test B — For all gases not used to supply drive gas to the ventilator.

Test A

For primary regulators that supply drive gas to the ventilator (O_2 or Air):

Under low flow conditions, the output pressure of a properly adjusted/ functioning regulator should fall within specifications listed in step 4. Under high flow conditions, the output pressure should not drop below the specifications in step 12.

1. Remove the bellows assembly.
2. Slowly open the cylinder valve.
3. Set the system switch to On.
4. **Low Flow Test:** Set the fresh gas flow to 0.05 L/min (or minimum flow for O_2). When checking an Air regulator on systems that have a single flowtube, open the needle valve 1/8 turn from the minimum stop to achieve a flow close to 0.05 L/min.
   - Close the cylinder valve and allow the pressure to decay to 2068 kPa (300 psi) as indicated on the cylinder gauge (upper limit of the red band). The flow may be temporarily increased to facilitate the decay.
   - At the time that the cylinder pressure reaches 2068 kPa (300 psi), set the system switch to Standby.
   - Within one minute, the test device must stabilize between:

     (60) DIN 372–400 kPa (54–58 psi)

     (50) Pin Indexed 310–341 kPa (45.0–49.5 psi).

     - If the test device pressure does not stabilize within one minute, replace the cylinder supply.
     - If the test device stabilizes within one minute, but the readings are not within specifications, readjust the regulator (Section 6.1.3).
5. Slowly open the cylinder valve.
6. Enter the Service Mode:
   (Push and hold the adjustment knob on the ventilator's display and set the system switch to On.)
7. Select and confirm "Service Modes."
8. Follow the menu structure outline below to reach the adjustment for the inspiratory flow valve. Select and confirm at each step.
   - "Diagnostics Tests/Tools"
   - "Valves - Test Tool"
   - "Set Inspiratory Valve"

9. **High Flow Test:** Rotate adjustment knob counterclockwise to obtain 65 (L/min):

   - While watching the test device press confirm.
   - After 2 seconds, select "Go to Diagnostic Tests/Tools Menu" and press confirm to stop the gas flow.
   - The minimum test device reading observed must be greater than:

   (60) DIN 221 kPa (32 psi)

   (50) Pin Indexed 207 kPa (30 psi)

   Repeat this step three times.

   If the test device reading under "high flow" conditions is less than specified, readjust the regulator per the procedure in Section 6.1.3; however, set the regulated pressure higher by the difference you noted in this step plus 7 kPa (1 psi). This adjusts the "low flow" regulated output to the high side of the specification so that the "high flow" regulated pressure can fall within the specification.

   If the regulator subsequently fails the "low flow" specification (step 4) because the reading is too high, replace the cylinder supply.

10. Set the system switch to Standby.
11. Close the cylinder valve.
12. Bleed the system of all pressure.
13. Disconnect the test device and plug the test port (pull on the plug to ensure it is locked in the fitting).
14. Replace the bellows assembly.
15. Replace the rear panel(s).
16. Perform the checkout procedure (Section 3).

Test B **For all gases not used to supply drive gas to the ventilator:**

Under low flow conditions, the output pressure of a properly adjusted/ functioning regulator should fall within specifications listed in step 4. Under high flow conditions, the output pressure should not drop below the specifications in step 7.

1. If the cylinder supply being tested is N_2O, connect a source of O_2 and set the O_2 flow control to the minimum stop (pilot pressure for secondary regulator).
2. Slowly open the cylinder valve for the regulator being tested.
3. Set the system switch to On.

4. **Low Flow Test:** Set the flow of the gas being tested to 0.05 L/min (or minimum flow for O_2). When checking a regulator on systems that have a single flowtube, open the needle valve 1/8 turn from the minimum stop to achieve a flow close to 0.05 L/min.
   - Close the cylinder valve and allow the pressure to decay to 2068 kPa (300 psi) as indicated on the cylinder gauge (upper limit of the red band). The flow may be temporarily increased to facilitate the decay.
   - At the time that the cylinder pressure reaches 2068 kPa (300 psi), set the system switch to Standby.
   - Within one minute, the test device must stabilize between:

     (60) DIN 372–400 kPa (54–58 psi)

     (50) Pin Indexed 310–341 kPa (45.0–49.5 psi).

     - If the test device pressure does not stabilize within one minute, replace the cylinder supply.
     - If the test device stabilizes within one minute, but the readings are not within specifications, readjust the regulator (Section 6.1.3).
5. Slowly open the cylinder valve.
6. Set the system switch to On.
7. **High Flow Test:** Set the flow control valve to the maximum indicated flow on the flow tube.
   - The test device reading must be greater than:

     (60) DIN 221 kPa (32 psi)

     (50) Pin Indexed 221 kPa (32 psi)

     - If the test device reading under “high flow” conditions is less than specified, readjust the regulator per the procedure in Section 6.1.3; however, set the regulated pressure higher by the difference you noted in this step plus 7 kPa (1 psi). This adjusts the “low flow” regulated output to the high side of the specification so that the “high flow” regulated pressure can fall within the specification.
     - If the regulator subsequently fails the “low flow” specification (step 4) because the reading is too high, replace the cylinder supply.
8. Set the system switch to Standby.
9. Close the cylinder valve.
10. Bleed the system of all pressure.
11. Disconnect the test device and plug the test port (pull on the plug to ensure it is locked in the fitting).
12. Replace the rear panel(s).
13. Perform the checkout procedure (Section 3).

6.1.3 Adjusting Primary Regulators

Important: Cylinder supplies in an Aespire machine must have all primary regulators set to the same pressure range: (50) Pin Indexed or (60) DIN. If a regulator is replaced, the replacement regulator must be set (as required) to the same specification as the one removed.

Important: Install a full cylinder in the cylinder supply to be adjusted. It is essential that the cylinder be within 10% of its full pressure.

If the cylinder supply being adjusted is N_2O, connect a source of O_2 and set the O_2 flow control to the minimum stop (pilot pressure for secondary regulator).

To adjust the primary regulators, follow the procedure in Section 6.1.1 to gain access to the regulators.

Do not attempt to adjust without flow.

1. Slowly open the cylinder valve.
2. Set the system switch to On.
3. Set and maintain the fresh gas flow of the gas being tested to 0.05 L/min (or minimum flow for O_2). When adjusting a regulator on systems that have a single flowtube, open the needle valve 1/8 turn from the minimum stop to achieve a flow close to 0.05 L/min.

4. Close the cylinder valve and allow the pressure to decay to 2068 kPa (300 psi) as indicated on the cylinder gauge (upper limit of the red band). The flow may be temporarily increased to facilitate the decay.
5. When the cylinder gauge reaches the upper limit of the red band, adjust the regulator output pressure to:

   (60) DIN 386–400 kPa (56–58 psi)

   (50) Pin Indexed 327–341 kPa (47.5–49.5 psi).

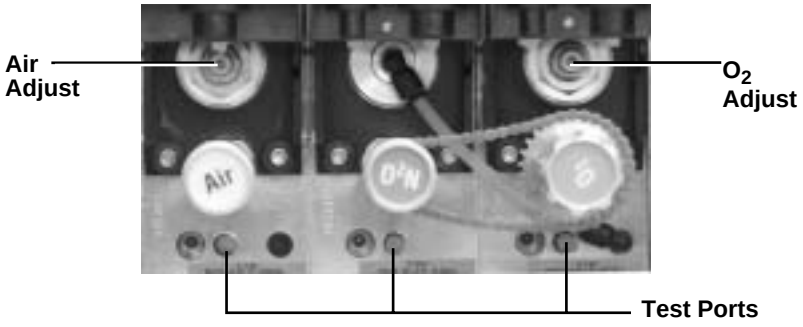
   Note: It may be necessary to open the cylinder valve and repeat steps 4 and 5 a number of times to achieve the above setting.
6. Test the regulator settings per the appropriate test in Section 6.1.2:
   - **Test A —** For primary regulators that supply drive gas to the ventilator.
   - **Test B —** For all gases not used to supply drive gas to the ventilator.

6.2 Secondary Regulators

⚠ WARNING When testing N_2O regulators, nitrous oxide flows through the system. Use a safe and approved procedure to collect and remove it.

6.2.1 Testing/Adjusting Secondary Regulators or Balance Regulators

1. Set the system switch to Standby.
2. Remove the flowmeter panel shield (Section 4.9.1).
3. Remove the plug from the test port and connect a test device capable of measuring 689 kPa (100 psi) using 1/8-inch nylon tubing.



4. Set the flow of the tested gas and of O_2 as detailed in the chart.
5. Verify that the output of the tested regulator is within the range listed in the chart.

Regulator	Output	Flow Regulated gas	Flow O_2
O_2	207 ±7 kPa (30 ±1 psi)	2 L/min	---------
Air	207 ±7 kPa (30 ±1 psi)	2 L/min	---------
N_2O	± 14 kPa (±2 psi) of O_2 reading	10 L/min	4 L/min

6. If required, adjust the O_2 and Air regulators to meet the above specifications. The N_2O regulator is not adjustable; replace if out of range.

   Note: The adjustment screws for these regulators are self-locking.

7. Disconnect the test device and plug the test port (pull on the plug to ensure it is locked in the fitting).
8. Perform the Flow Control Tests (Section 3.3).

6.3 Flowmeter Needle Valve Calibration

You need to calibrate a needle valve:

- if you install a new one,
- if minimum and maximum flows are not within specifications.

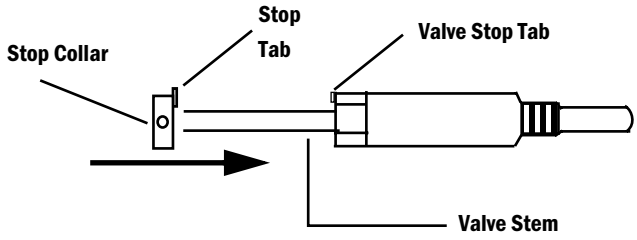
6.3.1 O_2 Needle Valve Calibration (Minimum Flow)

⚠ **CAUTION:** Do not force the needle valve against the seat. Overtightening the valve can cause the minimum flow setting to drift out of specifications.

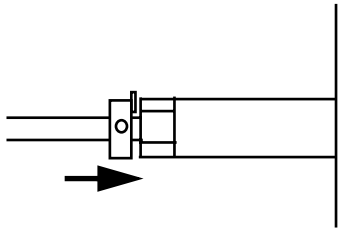
1. Set the system switch to Standby.
2. Remove the flowmeter panel shield (Section 4.9.1).

   Note: If adjusting an existing needle valve,

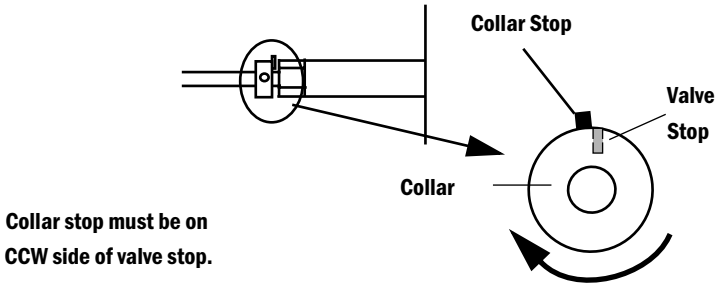
   - remove the N_2O and O_2 knob and sprocket assemblies (on machines with O_2 only flowhead, remove the O_2 knob),
   - and loosen the O_2 stop collar setscrews.
3. Slide a stop collar onto the valve stem with the stop tab toward the valve. Do not tighten setscrews.



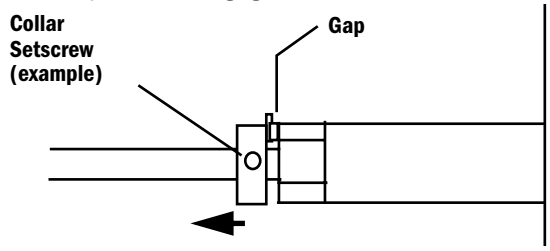
4. Set the system switch to On.
5. Adjust the O_2 needle valve to maintain a flow of
   - 50 ±25 mL/min for dual tube flowmeters.
   - 200 ±25 mL.min for single tube flowmeters.
6. Push the stop collar against the valve body.



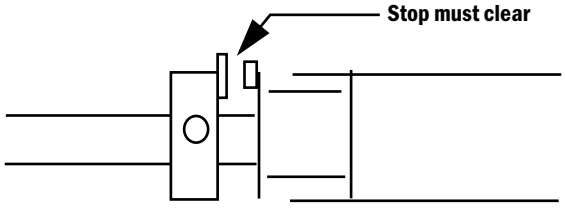
7. Turn the collar clockwise until the collar stop tab contacts the minimum stop tab on the valve body. *Do not turn the valve stem*.



8. Carefully pull the collar back so there is a slight gap between collar and the valve body (but still engages the valve stop).



9. Tighten the collar setscrews. Start with the one opposite the tab if possible.
10. Turn the valve stem counterclockwise at least one revolution to make sure the collar tab clears the valve stop.



If the stop does not clear:

a. Turn the valve stem back to minimum position.
b. Loosen the collar setscrews.
c. Repeat steps 6 through 9.

11. Turn the valve stem clockwise to the minimum stop.
12. Verify that the flow is within the
    - 50 ±25 mL/min range for dual tube flowmeters.
    - 200 ±25 mL/min range for single tube flowmeters.
13. Set the maximum stop collar if necessary (Section 6.3.4).

    Note: Maximum stop collars are required in Canada for all gas flow controls.

14. Calibrate the Link proportioning system (Section 6.4)
    (on machines with O_2 only flowhead, replace and set the knob so that at minimum flow the label text is horizontal; replace the flowmeter shield).

6.3.2 N_2O Needle Valve Calibration (Minimum Flow)

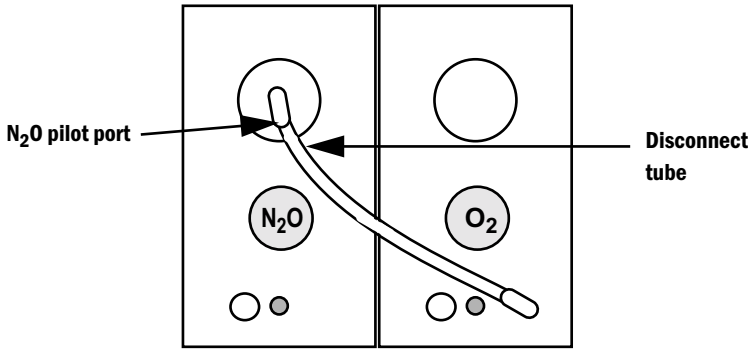
⚠ WARNING You must be in a well ventilated room or use a gas evacuation device at this time. Anesthetic vapors exhausted into the room air can be harmful to your health.

⚠ CAUTION: Do not force the needle valve against the seat. Overtightening the valve can cause the minimum flow setting to drift out of specifications.

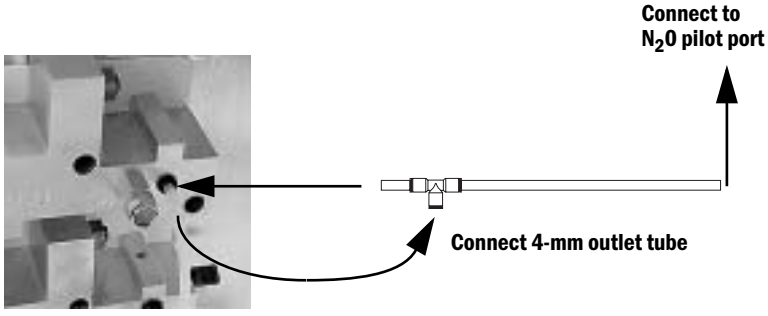
1. Disconnect all pipeline supplies and close all cylinder valves.
2. Remove the upper rear panel.

   Note: If adjusting an existing needle valve,

   - remove the N_2O and O_2 knob and sprocket assemblies,
   - and loosen the O_2 stop collar setscrews.
3. Remove the flowmeter panel shield (Section 4.9.1).
4. Disconnect the tube from the pilot port on the N_2O regulator.

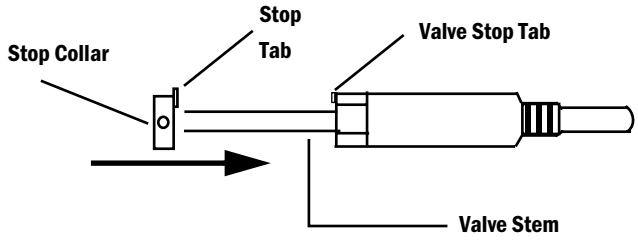


5. Disconnect the 4-mm outlet tube from the back of the N_2O pipeline manifold.



6. Using a 4-mm tube/tee fixture (see Service Tools - Section 8.1.3), connect a tube (tee end) to the N_2O supply outlet at the back of the pipeline manifold. Connect the outlet tube to the open connection on the tee connector of the fixture. Connect the other end of the fixture to the N_2O pilot port at the front of the flowhead. This setup supplies pilot pressure to the N_2O balancing regulator during the minimum stop calibration.

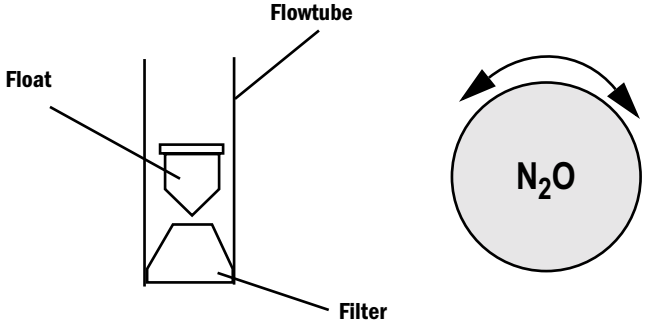
7. Slide a stop collar onto the valve stem with the stop tab toward the valve. Do not tighten setscrews.



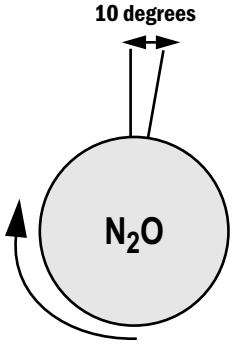
8. Connect either an N_2O pipeline or cylinder supply.
9. Slowly open the N_2O cylinder valve.

   Important: Do not connect the O_2 pipeline or open the O_2 cylinder valve.

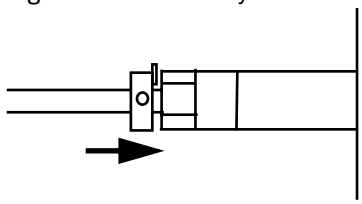
10. Adjust the needle valve until the float is nearly touching the filter, but not quite.



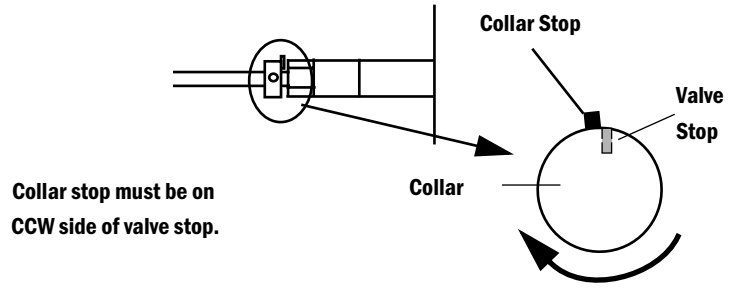
11. Disconnect the tubing from the inlet of the vaporizer manifold (closest to flowhead).
12. If the machine has an Air option, bleed down the air supply. Air can inflate the bubble (next step) if it is not shut off.
13. Apply a small amount of leak detection fluid (Snoop) to the end of the tube to form a bubble.
14. Turn the valve stem clockwise until the bubble no longer inflates. Do not turn more than 10 degrees clockwise past this point.



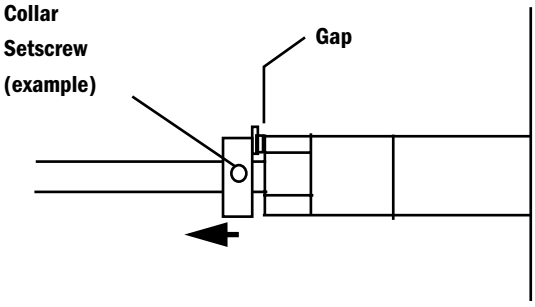
15. Push the stop collar against the valve body.



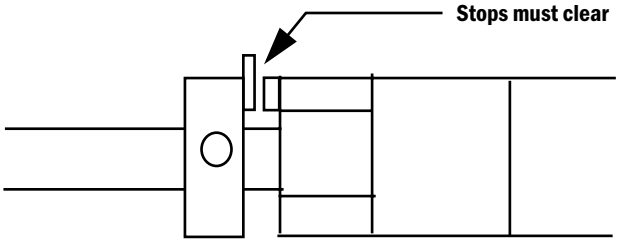
16. Turn the collar clockwise until the collar stop tab contacts the minimum stop tab on the valve body. *Do not turn the valve stem*.



17. Carefully pull the collar back so there is a slight gap between collar and the valve body (but still engages the valve stop).



18. Tighten the collar setscrews. Start with the one opposite the tab if possible.
19. Turn the valve stem counterclockwise at least one revolution to make sure the collar tab clears the valve stop.



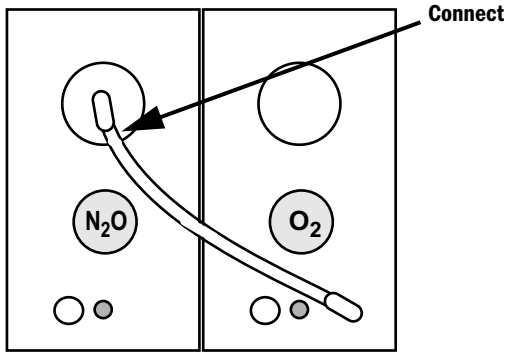
If the stops do not clear:

a. Turn the valve stem back to minimum position.
b. Loosen the collar setscrews.
c. Repeat steps 14 through17.

20. Turn the valve clockwise to the minimum stop.
21. Verify there is no flow at the end of the tube.
22. Thoroughly clean the end of the nylon tube and reconnect it to the vaporizer manifold inlet.
23. Set the maximum stop collar if necessary (Section 6.3.4).

    Note: Maximum stop collars are required in Canada for all gas needle valves.

24. After calibrating minimum flow for N_2O:
    a. Close the cylinder valve and use the needle valve to bleed the remaining gas.
    b. Remove the test fixture connecting the N_2O gas supply to pressure balance regulator pilot port.
    c. Reconnect the pilot tube to the N_2O pilot port. Pull on the tubing to ensure it is locked into the fitting.



    d. Reconnect the outlet tube to the N_2O pipeline supply manifold.
25. Calibrate the Link proportioning system (Section 6.4).

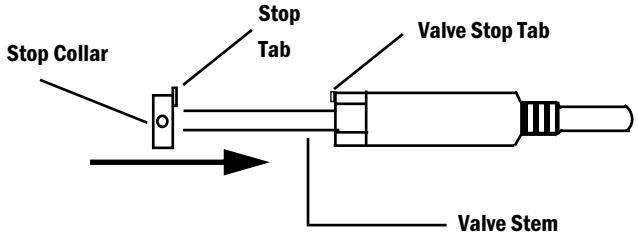
6.3.3 Air Needle Valve Calibration (Minimum Flow)

⚠ **CAUTION:** Do not force the needle valve against the seat. Overtightening the valve can cause the minimum flow setting to drift out of specifications.

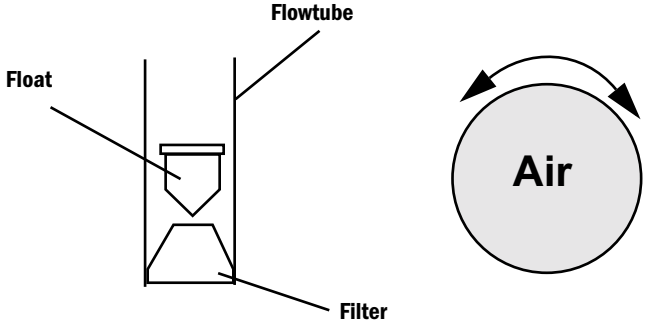
1. Set the system switch to Standby.
2. Disconnect all pipeline hoses and close all cylinder valves except for air.
3. Remove the flowmeter panel shield (Section 4.9.1).
4. Remove the upper rear panel.

   Note: If adjusting an existing needle valve,

   - remove the Air knob,
   - and loosen the Air stop collar setscrews.
5. Slide a stop collar onto the valve stem with the stop tab toward the valve. Do not tighten setscrews.

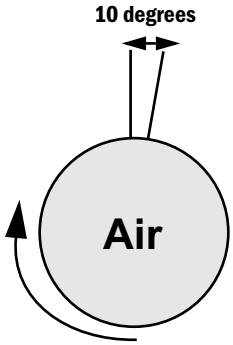


6. Set the system switch to On.
7. Adjust the needle valve until the float is nearly touching the filter, but not quite.

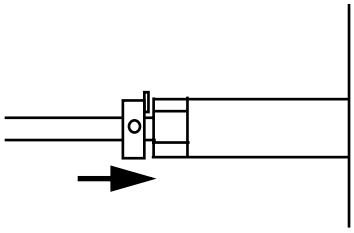


8. Disconnect the tubing from the inlet to the vaporizer manifold (left end of manifold).
9. Apply a small amount of leak detection fluid (Snoop) to the end of the tube to form a bubble.

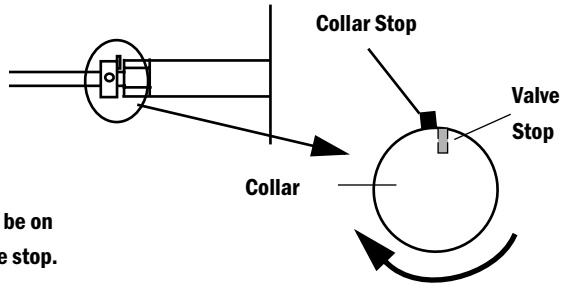
10. Turn the needle valve clockwise until the bubble no longer inflates. Do not turn more than 10 degrees clockwise past this point.



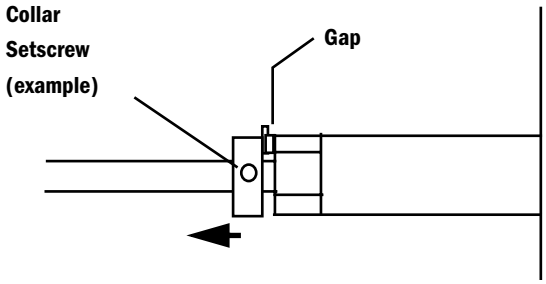
11. Push the stop collar against the valve body.



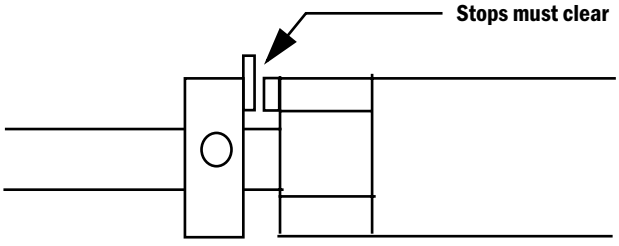
12. Turn the collar clockwise until the collar stop tab contacts the minimum stop tab on the valve body. ***Do not turn the valve stem***.



13. Carefully pull the collar back so there is a slight gap between collar and the valve body (but still engages the valve stop).



14. Tighten the collar setscrews. Start with the one opposite the tab if possible.
15. Turn the valve stem counterclockwise at least one revolution to make sure the collar tab clears the valve stop.



    If stops do not clear:

    a. Turn the valve stem back to minimum position.
    b. Loosen the collar setscrews.
    c. Repeat steps 11 through 14.

16. Turn the valve stem clockwise to the minimum stop.
17. Verify there is no flow at the end of the tube.
18. Thoroughly clean the end of the nylon tube and reconnect it to the vaporizer manifold inlet.
19. Set the maximum stop collar if necessary (Section 6.3.4).

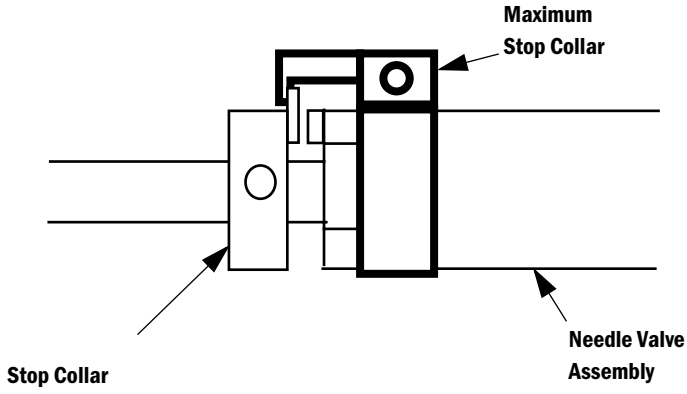
    Note: Maximum stop collars are required in Canada for all gas needle valves.

20. Set the knob so that at minimum flow the label text is horizontal and the knob is on an even plane (front to back) with the N_2O and O_2 knobs.
21. Replace the flowmeter panel shield and the rear panel.

6.3.4 Needle Valve Calibration (Maximum Flow)

Note: Maximum stop collars are required in Canada for all gas needle valves.

1. Calibrate the needle valve for minimum flow:
   - **Section 6.3.1** for O_2
   - **Section 6.3.2** for N_2O
   - **Section 6.3.3** for Air
2. Turn the valve open 1/2 turn beyond the maximum indicated flow.
3. Position the maximum stop collar so that its hook contacts the stop collar tab on the counterclockwise side. The hook and tab should have overlapping contact of about 0.75 mm (about half the thickness of the stop collar tab).



Note: This illustration shows the maximum stop collar in a vertical position. The actual position of the maximum stop collar may vary for each needle valve.

4. Tighten the locking screw on the maximum stop collar.
5. Turn the valve one full turn clockwise to make sure the hook does not contact the stop collar tab. If there is contact, move the maximum stop collar slightly forward.
6. Verify that you can turn the valve open 1/2 turn beyond the maximum indicated flow.
7. Turn the valve fully clockwise to the minimum stop.

6.4 Link system calibration

Before you start, make sure that:

- All parts are correctly installed.
- Stops on needle valves are set correctly.
- The machine meets leak check requirements.
- Confirm that the O_2 sensor measures 21% in room air and 100% in pure O_2. If not, calibrate the O_2 sensor.

Note: All illustrations in this section show ANSI flowmeter module positions. The order is reversed on ISO machines.

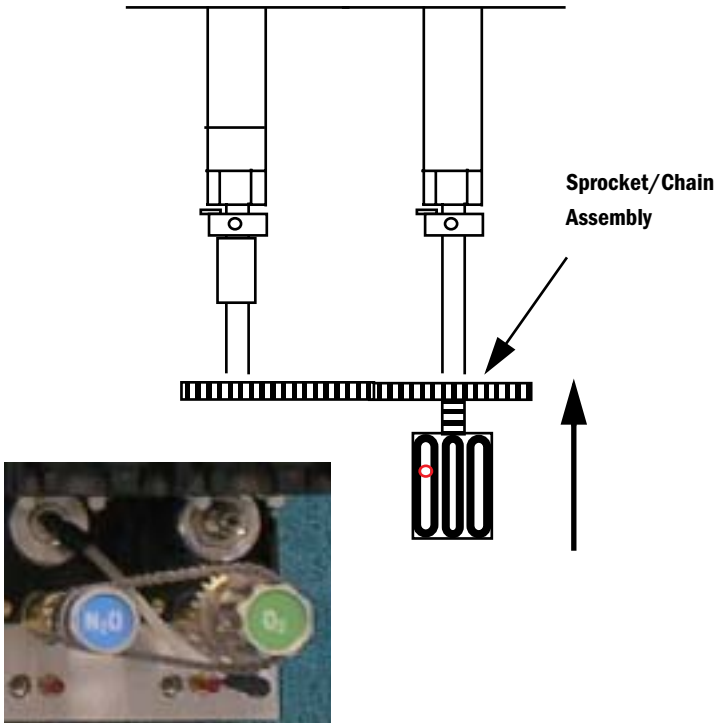
⚠ WARNING You must be in a well ventilated room or use a gas evacuation device at this time. Anesthetic vapors exhausted into the room air can be harmful to your health.

1. Set the system switch to Standby.
2. Remove the flowmeter panel shield (Section 4.9.1).
3. Put the plastic spacer on the N_2O needle valve spindle.
4. Turn the O_2 and the N_2O needle valves clockwise to their minimum stop position.

5. Put the chain onto the O_2 knob/sprocket assembly and the N_2O sprocket.

   Note: The N_2O sprocket set screws should be away from the valve.

6. Install the chain and sprockets onto the needle valve stems as an assembly. Press the O_2 knob/sprocket against the O_2 minimum stop collar.

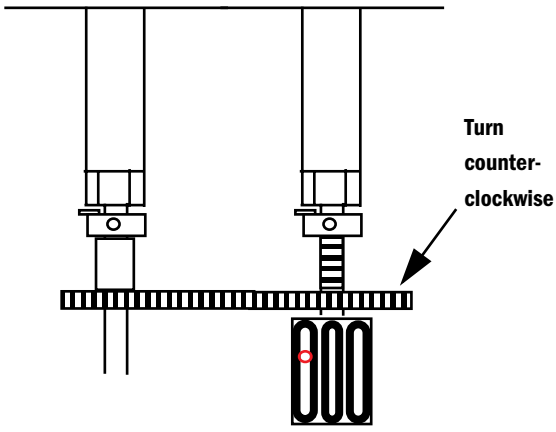


7. Tighten the setscrews in the O_2 knob. Do not tighten the N_2O sprocket setscrews.

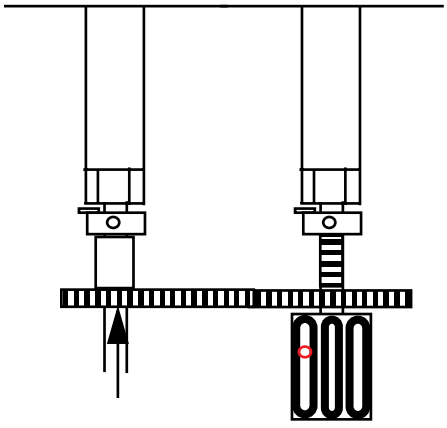
   Note: If O_2 label is on the knob, turn the knob so that the identification label is horizontal before tightening the setscrews.

8. Turn on the O_2 and the N_2O gas supplies (pipeline or cylinder).
9. Set the system switch to On.
10. Adjust the needle valves:
    - **O_2 needle valve:** 200 ±10 mL/min.
    - **N_2O needle valve:** 600 ±25 mL/min.

11. Turn the sprocket on the O_2 knob sprocket assembly counterclockwise until it stops against the tab on the O_2 knob. Do not allow the N_2O or O_2 valve stems to rotate.

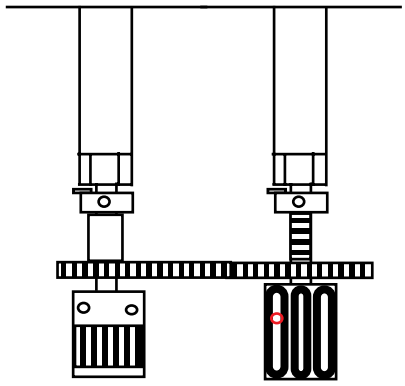


12. Push the N_2O sprocket against the plastic spacer.



13. Holding the O_2 knob, rotate the N_2O sprocket counterclockwise until all slack is removed from the chain.
14. Lightly tighten both N_2O sprocket setscrews.
15. Turn the N_2O needle valve clockwise to the minimum stop position.

16. Install the N_2O knob. Turn the knob so that the identification label is horizontal before tightening the setscrews.



17. Turn the N_2O needle valve counterclockwise, and check that the oxygen flow increases as N_2O flow increases.
18. Turn the O_2 needle valve clockwise, and check that the N_2O flow decreases as O_2 decreases.
19. Check the proportioning system concentration (increasing N_2O flow). Observe the following precautions:
    - Start with both valves at the minimum setting.
    - Adjust only the N_2O needle valve.
    - Increase the N_2O flow as specified in the table below and make sure the O_2 concentration is in the allowed range.

    Note: Allow the O_2 monitor to stabilize. At the lower flows, the O_2 monitor may take up to 90 seconds to stabilize.

    - If you overshoot a setting, turn the O_2 needle valve clockwise until the N_2O flow decreases to the previous setting before continuing the test.

Set the N_2O flow (L/min)	Measured O_2
0.8	22% to 29%
1	22% to 29%
2	22% to 29%
6	22% to 29%
9	22% to 29%

20. Check the proportioning system concentration (decreasing O_2 flow). Observe the following precautions:

    - Turn the N_2O needle valve to the maximum setting.
    - Adjust only the O_2 needle valve.
    - Decrease the O_2 flow as specified in the table and make sure the O_2 concentration is in the allowed range.

    Note: Allow the O_2 monitor to stabilize. At the lower flows, the O_2 monitor may take up to 90 seconds to stabilize.

    - If you overshoot a setting, turn the N_2O needle valve counterclockwise until the O_2 flow increases to the previous setting before continuing the test.

Set the O_2 flow (L/min)	**Measured O_2**
3	22% to 29%
2	22% to 29%
1	22% to 29%
0.3	22% to 29%

    If both tests meet the criteria, calibration is complete (go to the next step). If either test fails to meet the criteria, return to step 10 and adjust N_2O to a lower or higher setting.

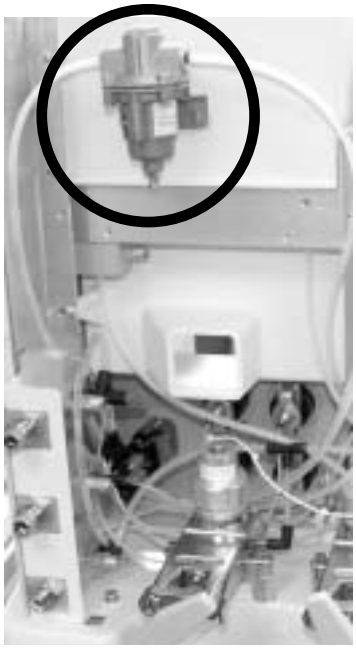
If:	**Then:**
Concentration Low	Decrease N_2O
Concentration High	Increase N_2O

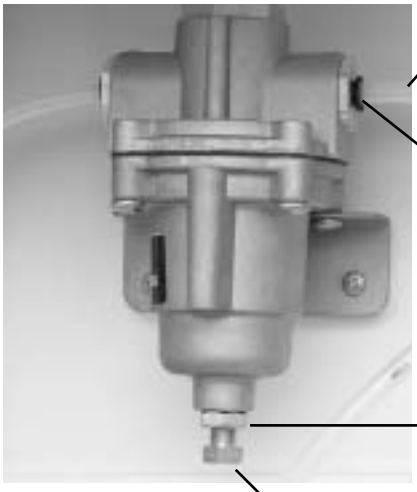
    Note: Adjusting the regulator pressure is not recommended. It has little effect on proportioning. If you have difficulty proportioning the system, you may need to replace either or both needle valves.

21. Tighten N_2O sprocket setscrews.
22. Set the system switch to Standby.
23. Turn off the O_2 and the N_2O gas supplies.
24. Check that all setscrews are tight.
25. Adjust all needle valves to minimum stop position.
26. Install flowmeter panel shield.

6.5 O_2 Flush Regulator

1. Bleed all gas pressure for the machine (Section 4.2).
2. Ensure that all cylinder and pipeline gauges read zero before proceeding.
3. Remove the upper rear panel (Section 4.3).
4. Remove the O_2 Flush Regulator output tubing. Attach a 6-mm tee and a test device to the open port.





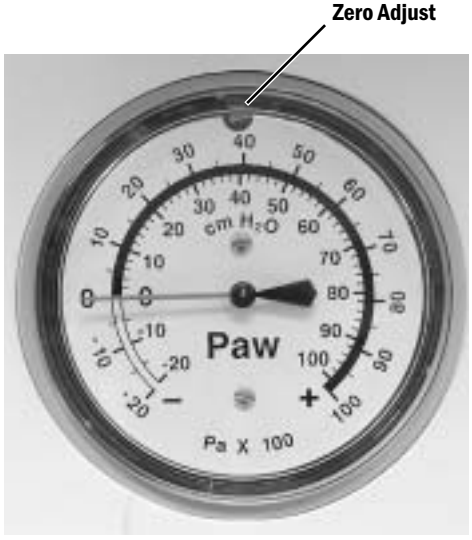
5. Connect an O_2 pipeline supply or slowly open the O_2 cylinder valve.
6. Push the flush button just enough to achieve a slight flow or open the auxiliary flowmeter if equipped with this option. Read the pressure shown on the test device.

   The pressure should be 241 ±7 kPa (35 ±1.0 psi).
7. If adjustment is required:
   a. Loosen the adjustment screw's jam nut.
   b. Adjust the regulator (in small steps) to the above specification.
   c. Tighten the jam nut.
   d. Verify the reading.
8. Disconnect the pipeline supply or close the cylinder valve.
9. Bleed gas pressure by pushing the flush button; then, disconnect the tee and test device.
10. Reattach the output tubing to the regulator.
11. Install the rear panel.

6.6 Airway pressure gauge

6.6.1 Zero the pressure gauge

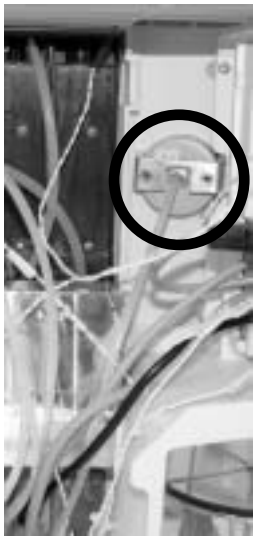
1. Attach a patient circuit to the Breathing System. Leave the patient end open.
2. Set the Bag/Vent switch to Bag.
3. Adjust the APL valve to maximum.
4. Remove the lens from the pressure gauge:
   - Apply a slight pressure with your thumb and finger tips around the outer edge of the lens.
   - Turn the lens counterclockwise to remove it.
5. Adjust the pressure gauge to zero.
6. Plug the patient circuit.
7. Press and release the O_2 flush button to sweep the needle across the pressure gauge.
8. Remove the plug from the patient circuit to relieve the pressure in the circuit and recheck the zero setting of the pressure gauge.
9. If required, repeat zero and span procedure.
10. Replace the lens cover.



6.6.2 Checking the pressure gauge accuracy

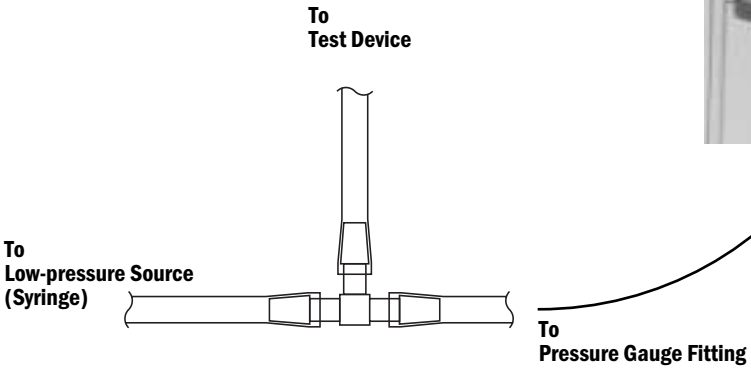
The accuracy of the airway pressure gauge can be checked by using the following:

- a low-pressure test device (digital manometer or test gauge) with an accuracy of ±2% of reading,
- a low-pressure supply source (typically a syringe),
- and an airway pressure gauge test adapter.



1. Ensure that the pressure gauge is zeroed (Section 6.6.1).
2. Remove the upper rear panel.
3. Remove the existing tube from the back of the pressure gauge and connect the test adapter tube directly to the gauge.
4. Connect a low-pressure supply source (syringe) to one of the open tubes of the test adapter.
5. Connect a low-pressure test device to the remaining open tube of the test adapter.
6. Adjust the pressure source to the following pressures as read on the airway pressure gauge. The test device gauge should read within the values indicated.

Airway Pressure Gauge	Test Device
0 cm H_2O	0 ±1 cm H_2O
40 cm H_2O	40 ±2 cm H_2O
-5 cm H_2O	-5 ±2 cm H_2O



Notes

7 Troubleshooting

In this section

This section covers the troubleshooting procedures for the Aespire machine pneumatic systems. For troubleshooting electrical systems, refer to the 7100 Ventilator Technical Reference manual.

7.1 General Troubleshooting 7-2

7.2 Breathing System Leak Test Guide 7-4

7.2.1 Breathing system leak test 7-5

7.2.2 Breathing System Troubleshooting Flowcharts 7-7

7.2.3 Leak Isolation Tests 7-12

7.1 General Troubleshooting

⚠ **WARNING** Objects in the breathing system can stop gas flow to the patient. This can cause injury or death:

- Do not use a test plug that is small enough to fall into the breathing system.
- Make sure that there are no test plugs or other objects caught in the breathing system.

Problem	Possible Cause	Action
High Pressure Leak	Pipeline leak	Use a leak detector or Snoop to check for source of leak. Repair or replace defective parts.
	O_2 flush valve	Use a leak detector or Snoop to check for source of leak. Make sure tubing connections are tight. Replace valve if defective.
	System switch	Use a leak detector or Snoop to check for source of leak. Make sure tubing connections are tight. Replace switch if defective.
	Cylinder not installed properly	Make sure cylinder is correctly aligned. Verify that tee handles are tight.
	Cylinder gauges	Use a leak detector or Snoop to check for source of leak. Replace gauge if defective.
	Cylinder gaskets	Use a leak detector or Snoop to check for source of leak. Replace gasket if defective.
	Relief valves	Use a leak detector or Snoop to check for source of leak. Replace valve if defective.
Low Pressure Leak (with vaporizer mounted)	Vaporizer not installed properly	Reseat vaporizer if not installed properly. Have vaporizer serviced at vaporizer center if vaporizer leaks.
	Missing or damaged o-ring on vaporizer manifold	Check condition of o-ring. Replace if missing or damaged.
	Loose fill port	Check fill port. Tighten if loose.

Problem	Possible Cause	Action
Low Pressure Leak (with or without vaporizer)	Leaking port valve on vaporizer manifold	Use the Vaporizer Manifold Valve Tester to check for leak. See Section 4.10.2 for instructions. If test fails, tighten, repair, or replace as needed.
	Leak at flowmeter head	If vaporizer manifold passed previous tests: Remove tubing from input side of head and occlude port. Perform leak test. If test fails: • Check for damaged o-rings between flowmeter modules. Replace as needed. • Check for damaged o-rings at top and bottom of flow tubes. Replace as needed. • Check for cracked flow tube. Replace as needed.
		If secondary regulator leaks, replace the complete module.
		Note: An alternate method is to pressurize the system and use a leak detector or Snoop to check for source of leak.
	Leaking relief valve on vaporizer manifold	Remove relief valve. Occlude opening. Perform leak test. If test passes, replace valve.
	Leaking flush valve	Attach pressure measuring device on CGO. Replace valve if device shows increased pressure.
	Leaking system switch	Attach pressure measuring device on CGO. Replace switch if device shows increased pressure.
Bellows leak	Pop-off valve diaphragm not sealing properly	Disassemble pop-off valve; inspect and clean seats; reseat; reassemble.
	Bellows mounting rim loose	Remove rim and pop-off valve diaphragm; reseat diaphragm; snap rim (2) into place.
	Bellows improperly mounted or has a hole or tear	Check that only the last bellows convolute is mounted to the rim and that the ring roll is in the groove under the rim. Inspect the bellows for damage; replace.
Breathing System Leak	Absorber canister not installed properly	Install canister properly.
	Soda lime dust on canister seals	Clean seals and mating surfaces.
Breathing System Leak (Intermittent)	ACGO O_2 sense check valve	Replace.
N_2O flow does not decrease with O_2 flow	Defective pilot regulator	Check pilot regulator. Replace if needed.
Unit displays low O_2 pressure with pipeline but not with cylinders	Low O_2 supply switch	Check switch. Calibrate or replace as appropriate.
Unable to begin mechanical ventilation	ABS not fully engaged	Remount ABS.
	No O_2 supply	Check O_2 supply.
	Defective Bag/Vent switch	Check Bag/Vent switch.

7.2 Breathing System Leak Test Guide

Note Always perform the low-pressure leak test (Section 3.5) on the machine before proceeding with these breathing system leak tests.

The procedure in Section 7.2.1 helps you isolate the leak: to Bag Mode components, to Vent Mode components, or to components that are common to both modes.

- If you have a similar leak in both the bag mode and the ventilator mode, you must consider the Flow Sensor Module, the Circuit Module, the Absorber Canister area, and the bulkhead components (including CGO tubing). Carefully inspect the circuit module for damaged seals or misassembly, and the seating of the O_2 sensor.
- If you have a larger leak in one area than the other (Vent or Bag), the leak is most likely NOT in the Flow Sensor Module, the Circuit Module, the Absorber Canister area, or the bulkhead ports.

Follow the troubleshooting flowcharts in Section 7.2.2 to determine the best sequence of tests for locating a breathing system leak.

The procedures in Section 7.2.3 test specific components of the breathing system for leaks.

⚠ WARNING Objects in the breathing system can stop gas flow to the patient. This can cause injury or death:

- Do not use a test plug that is small enough to fall into the breathing system.
- Make sure that there are no test plugs or other objects caught in the breathing system.

7.2.1 Breathing system leak test

This test checks for leaks in Vent Mode and Bag Mode components. It is part of the overall checkout procedure, Section 3.7 “Breathing system tests.” It is repeated here for testing convenience.

⚠ WARNING Objects in the breathing system can stop gas flow to the patient. This can cause injury or death:

- Do not use a test plug that is small enough to fall into the breathing system.

1. Verify that AGSS is operating. For systems that have a flow indicator on the side, make sure that the flow indicator shows a flow in the green (normal) region.
2. Zero the pressure gauge (Section 6.6.1).

Check Valves

3. Make sure that the check valves on the breathing circuit module work correctly:
   a. The Inspiratory check valve rises during inspiration and falls at the start of expiration.
   b. The Expiratory check valve rises during expiration and falls at the start of inspiration.

Ventilator Bellows

4. Ventilator bellows test:
   a. Set the system switch to Standby.
   b. Set the Bag/Vent switch to Ventilator.
   c. Set all flow controls to minimum.
   d. Close the breathing circuit at the patient connection. Use the test plug located on the side of the ABS.
   e. Push the O_2 flush button to fill the bellows.
   f. The pressure must not increase to more than 15 cm H_2O on the pressure gauge.
   g. If the bellows falls more than 100 mL/min (top of indicator), it has a leak.

Service Mode Tests

5. Enter the Service Mode: Push and hold the adjustment knob on the ventilator’s display and set the system switch to On.
   a. Select and confirm “Service Modes.”
   b. Follow the menu structure outline below to reach the adjustment for the inspiratory flow valve. Select and confirm at each step.
      - “Diagnostics Tests/Tools”
      - “Breathing System Leak Test”
   c. Follow the instructions on the screen.
   d. The leak rate should be less than 200 mL/min.
      For machines with a single-tube O_2 flowmeter, the pressure reading should reach 30 cm H_2O at minimum flows greater than 200 mL/min.

Note: If test fails, see Section 7.2, “Breathing System Leak Test Guide”.

Bag Circuit

6. Test the Bag circuit for leaks:
   a. Set the system switch to On.
   b. Set the Bag/Ventilator switch to Bag.
   c. Plug the Bag port (use your hand or the approved test plug).
   d. Close the APL valve (70 cm H_2O).
   e. Set the O_2 flow to 0.25 L/min.
   f. Close the patient connection (using a hand or test plug on the side of the breathing system) and pressurize the bag circuit with the O_2 flush button to approximately 30 cm H_2O.
   g. Release the flush button. The pressure must not decrease. A pressure decrease large enough to see on the gauge indicates an unacceptable leak.

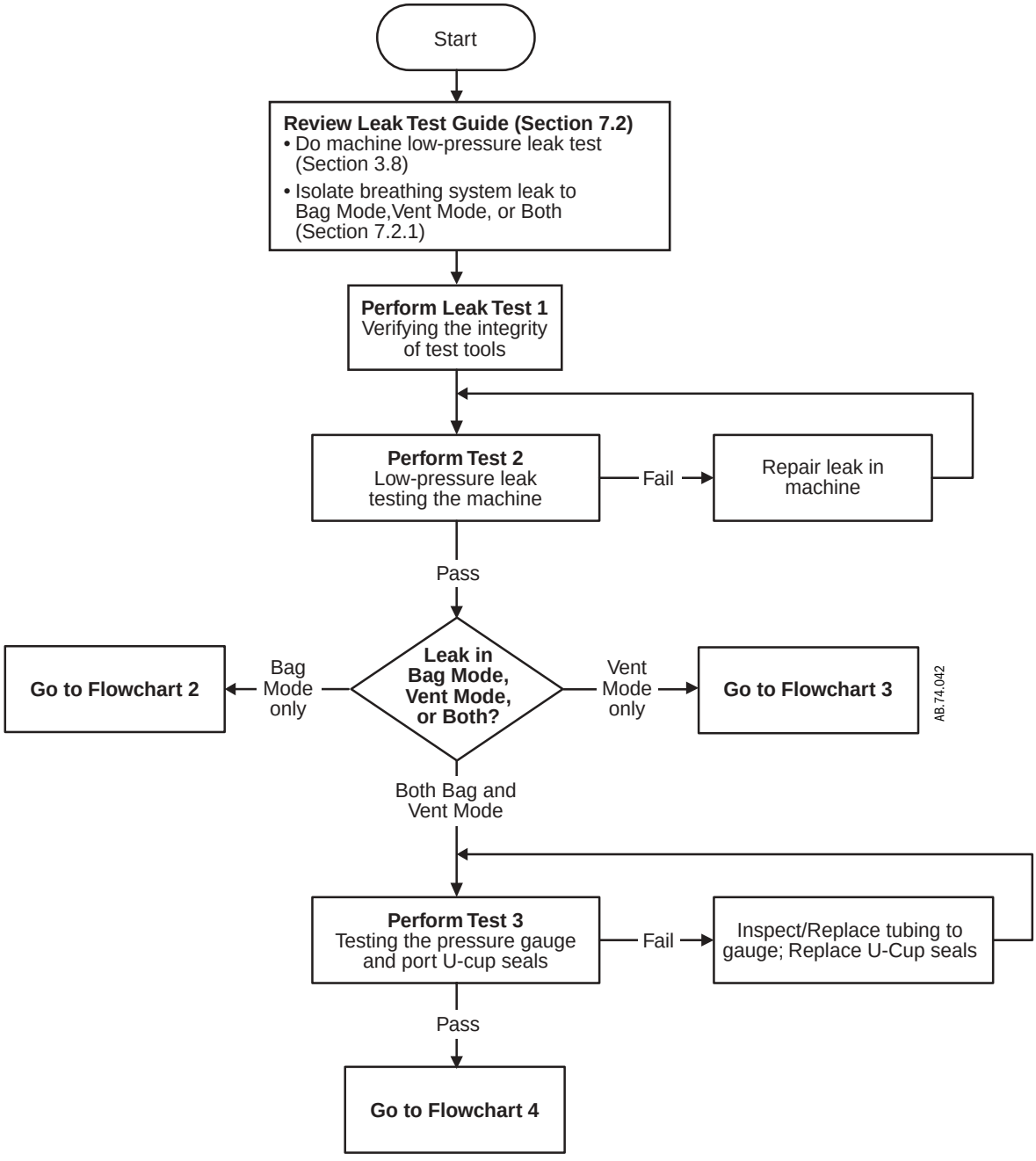
Note: If test fails, see Section 7.2, “Breathing System Leak Test Guide”.

APL Valve

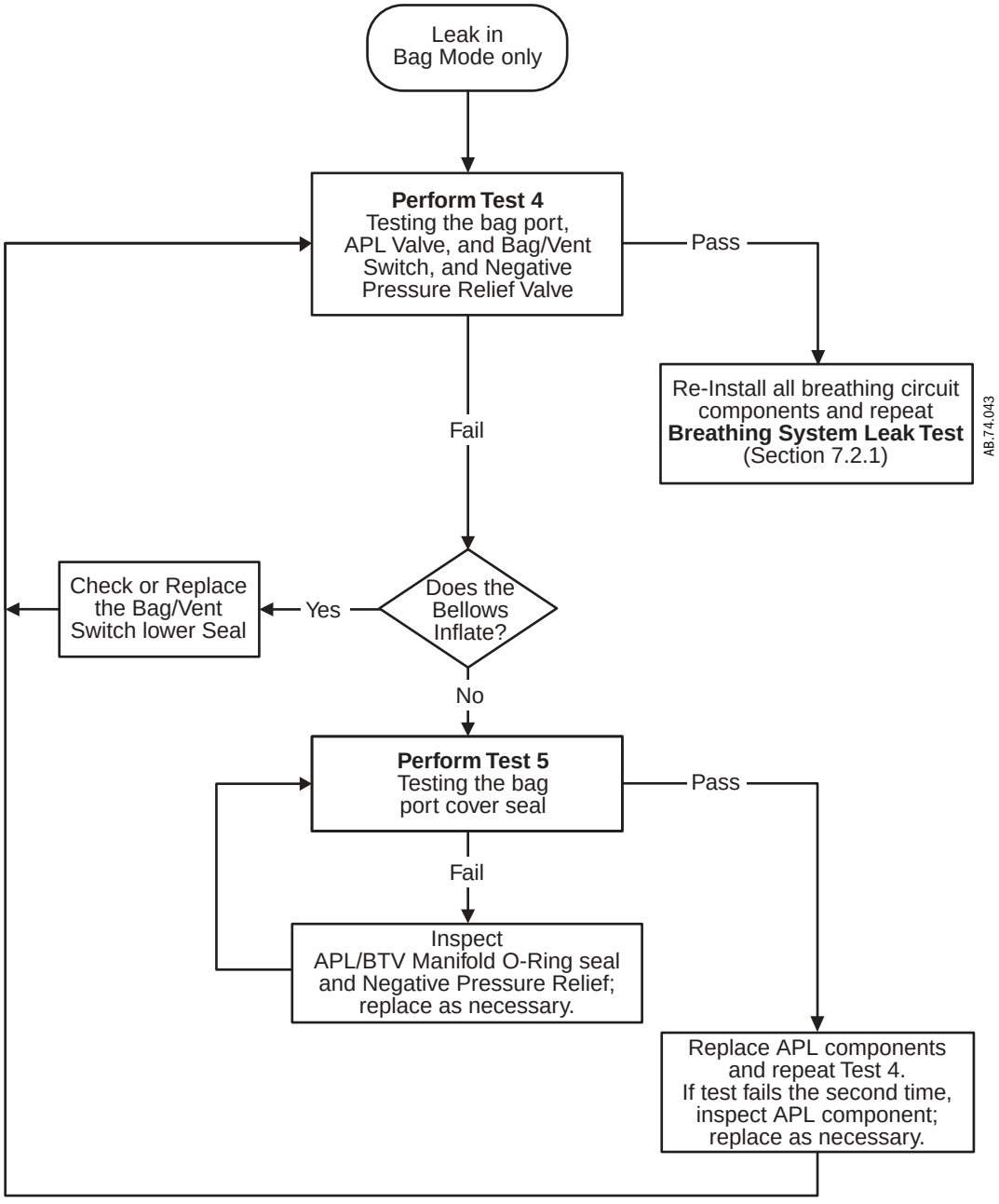
7. Test the APL valve:
   a. Fully close the APL valve (70 cm H_2O).
   b. Set the total fresh gas flow to approximately 3 L/min and make sure that the value on the inspiratory pressure gauge does not exceed 85 cm H_2O. Some pressure fluctuation is normal.
   c. Fully open the APL valve (to the MIN position).
   d. Set O_2 flow to 3 L/min. Turn any other gases off.
   e. Make sure that the value on the inspiratory pressure gauge is less than approximately 5 cm H_2O.
   f. Push the O_2 flush button. Make sure that the value on the inspiratory pressure gauge stays less than 10 cm H_2O.
   g. Set the O_2 flow to minimum and make sure that the value on the inspiratory pressure gauge does not decrease below 0 cm H_2O.
8. Remove your hand or the test plug from the patient connection.
9. Set the System switch to Standby.

⚠ WARNING Make sure that there are no test plugs or other objects caught in the breathing system.

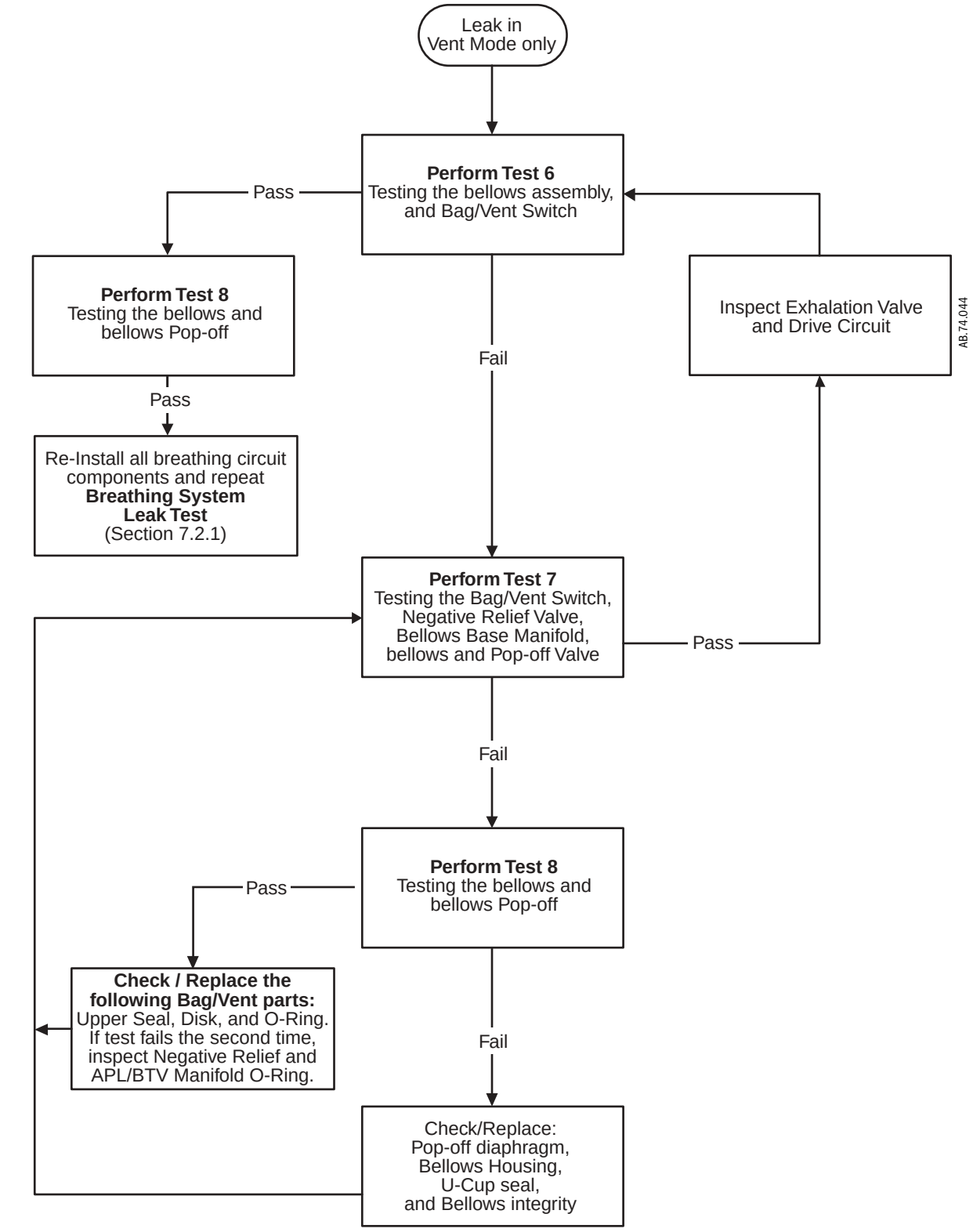
7.2.2 Breathing System Troubleshooting Flowcharts



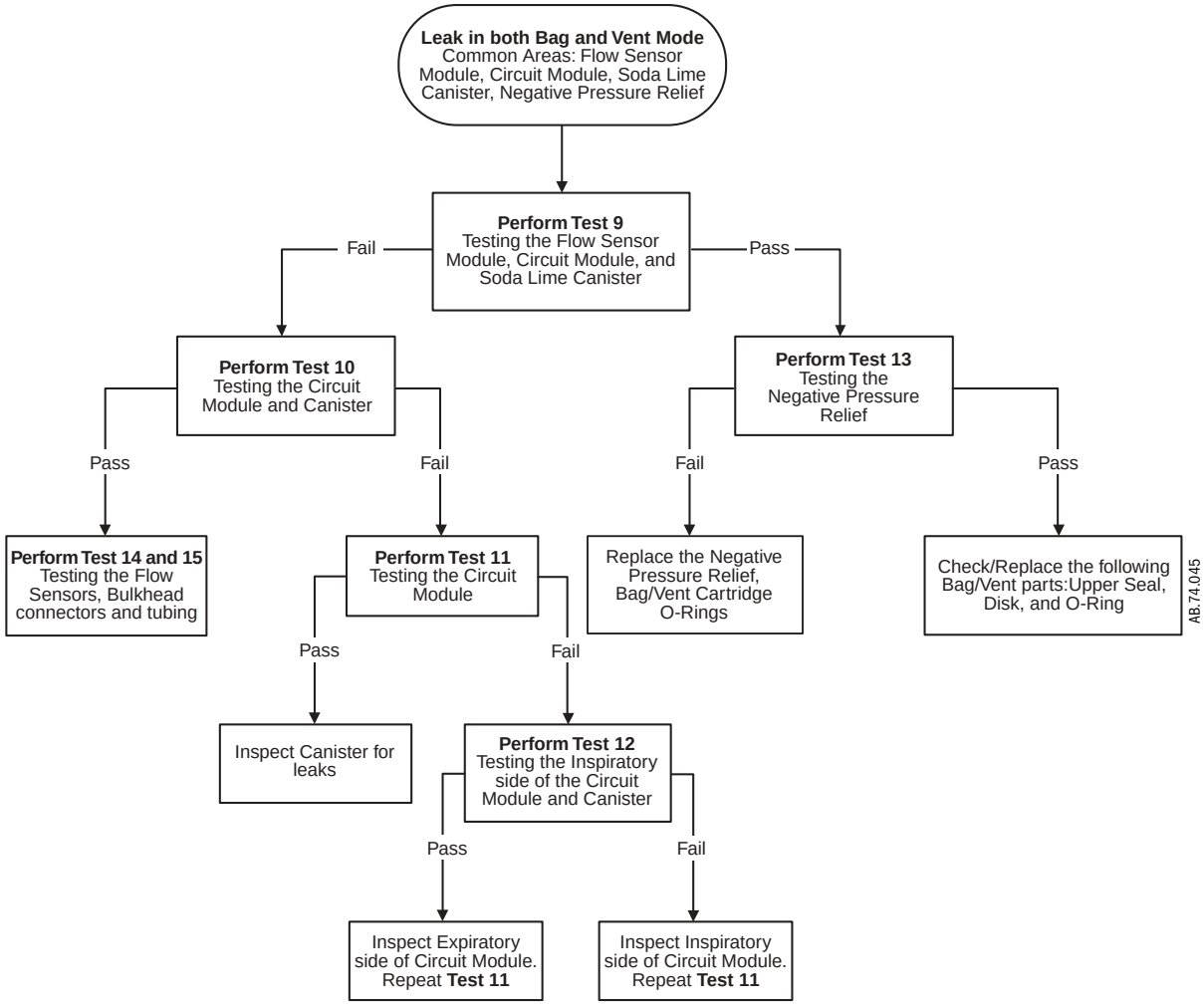
Flowchart ***1***


Leak in
Bag Mode only
Perform Test 4
Testing the bag port,
APL Valve, and Bag/Vent
Switch, and Negative
Pressure Relief Valve
Pass
Re-Install all breathing circuit
components and repeat
Breathing System Leak Test
(Section 7.2.1)
AB.74.043
Fail
Does the
Bellows
Inflate?
Yes
Check or Replace
the Bag/Vent
Switch lower Seal
No
Perform Test 5
Testing the bag
port cover seal
Pass
Fail
Inspect
APL/BTV Manifold O-Ring seal
and Negative Pressure Relief;
replace as necessary.
Replace APL components
and repeat Test 4.
If test fails the second time,
inspect APL component;
replace as necessary.

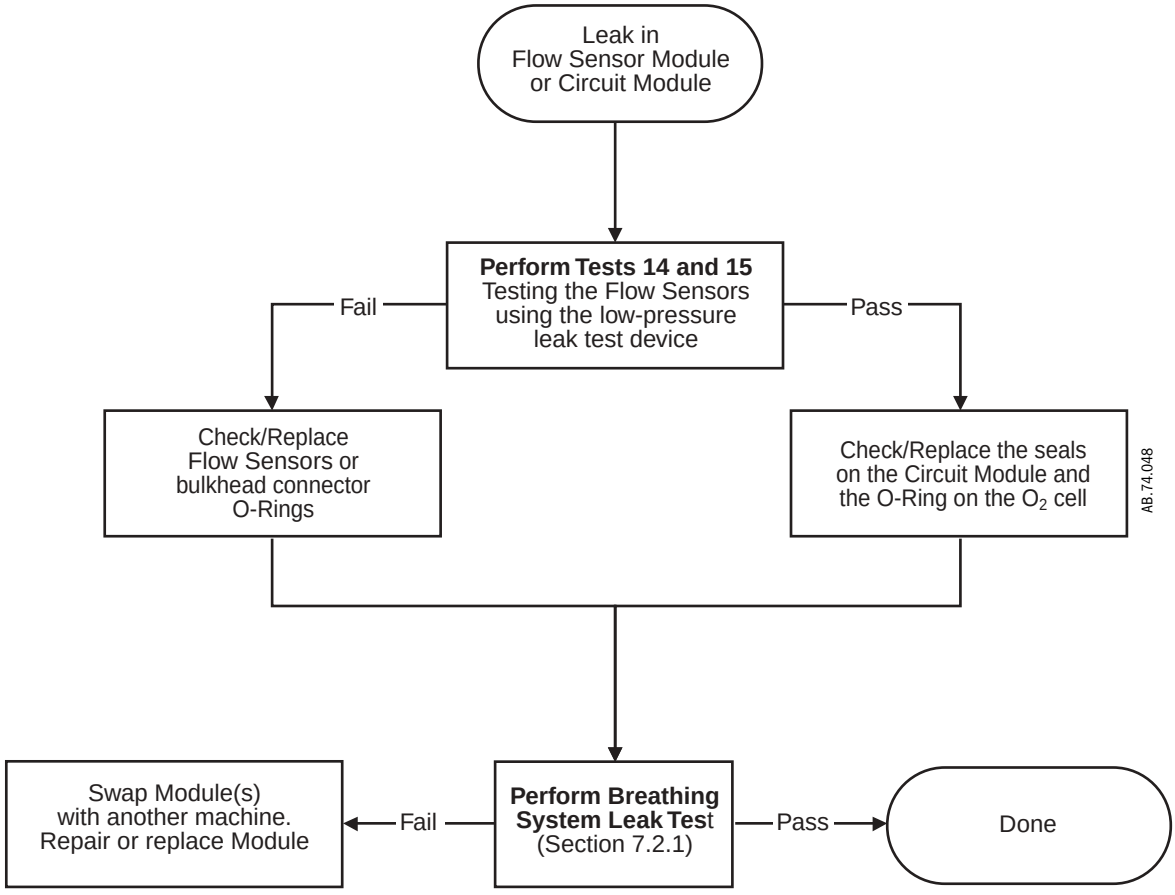
Flowchart 2


Leak in
Vent Mode only
Perform Test 6
Testing the bellows assembly,
and Bag/Vent Switch
Pass
Perform Test 8
Testing the bellows and
bellows Pop-off
Pass
Re-Install all breathing circuit
components and repeat
Breathing System
Leak Test
(Section 7.2.1)
Fail
Inspect Exhalation Valve
and Drive Circuit
AB.74.044
Perform Test 7
Testing the Bag/Vent Switch,
Negative Relief Valve,
Bellows Base Manifold,
bellows and Pop-off Valve
Pass
Fail
Perform Test 8
Testing the bellows and
bellows Pop-off
Pass
Check / Replace the
following Bag/Vent parts:
Upper Seal, Disk, and O-Ring.
If test fails the second time,
inspect Negative Relief and
APL/BTV Manifold O-Ring.
Fail
Check/Replace:
Pop-off diaphragm,
Bellows Housing,
U-Cup seal,
and Bellows integrity

Flowchart 3


Leak in both Bag and Vent Mode
Common Areas: Flow Sensor Module, Circuit Module, Soda Lime Canister, Negative Pressure Relief
Perform Test 9
Testing the Flow Sensor Module, Circuit Module, and Soda Lime Canister
Fail
Pass
Perform Test 10
Testing the Circuit Module and Canister
Perform Test 13
Testing the Negative Pressure Relief
Pass
Fail
Fail
Pass
Perform Test 14 and 15
Testing the Flow Sensors, Bulkhead connectors and tubing
Perform Test 11
Testing the Circuit Module
Replace the Negative Pressure Relief, Bag/Vent Cartridge O-Rings
Check/Replace the following Bag/Vent parts:Upper Seal, Disk, and O-Ring
AB.74.045
Pass
Fail
Inspect Canister for leaks
Perform Test 12
Testing the Inspiratory side of the Circuit Module and Canister
Pass
Fail
Inspect Expiratory side of Circuit Module. Repeat Test 11
Inspect Inspiratory side of Circuit Module. Repeat Test 11

Flowchart 4


Leak in
Flow Sensor Module
or Circuit Module
Perform Tests 14 and 15
Testing the Flow Sensors
using the low-pressure
leak test device
Fail
Pass
Check/Replace
Flow Sensors or
bulkhead connector
O-Rings
Check/Replace the seals
on the Circuit Module and
the O-Ring on the O_2 cell
AB.74.048
Swap Module(s)
with another machine.
Repair or replace Module
Fail
Perform Breathing
System Leak Test
(Section 7.2.1)
Pass
Done

Flowchart 5

7.2.3 Leak Isolation Tests

The previous flowcharts refer you to the following tests.

These tests require the use of the Low Pressure Leak Test Device and the Leak Test Tool Kit (refer to Section 8.1, "Service tools – Anesthesia machine".

The Leak Test Tool Kit includes:

- the Machine Test Tool
- the Circuit Test Tool
- and various Test Plugs

When performing these tests, ensure that the ACGO selector switch is set to the ABS position.

Test 1 Verifying the integrity of the test tools. 7-13

Test 2 Low-pressure leak testing the machine 7-14

Test 3 Testing the airway pressure gauge, and Port 1 and Port 3 u-cup seals 7-15

Test 4 Testing the bag port cover, the APL valve, the Bag/Vent switch, and the negative pressure relief valve 7-16

Test 5 Testing the APL diaphram 7-17

Test 6 Testing the bellows module and the Bag/Vent switch 7-18

Test 7 Testing the bellows, the bellows pop-off valve, the bellows base manifold, and the Bag/Vent switch 7-19

Test 8 Testing the bellows assembly 7-20

Test 9 Testing the flow sensor module, the circuit module, and the soda lime canister . 7-21

Test 10 Testing the circuit module and the canister 7-22

Test 11 Testing the circuit module 7-22

Test 12 Testing the inspiratory side of the circuit module 7-23

Test 13 Testing the negative pressure relief valve. 7-24

Test 14 Testing the flow sensors only. 7-25

Test 15 Testing a flow sensor including the Ventilator Monitoring Assembly and interfacing components 7-26

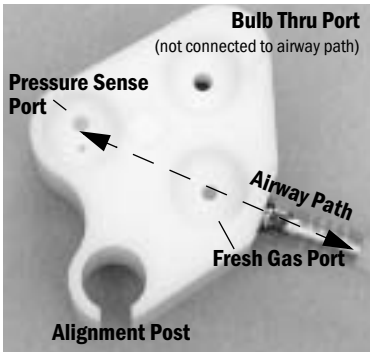
⚠ WARNING Objects in the breathing system can stop gas flow to the patient. This can cause injury or death:

- Do not use a test plug that is small enough to fall into the breathing system.
- Make sure that there are no test plugs or other objects caught in the breathing system.

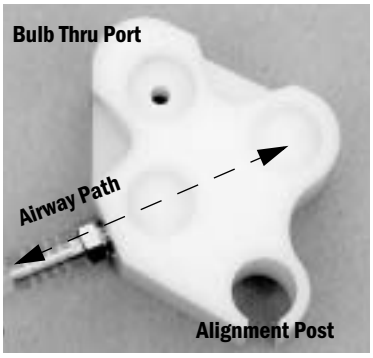
⚠ CAUTION Do not use O_2 Flush for leak isolation tests. Do not leave pressurized systems unattended. High pressure and equipment damage may result.

Test 1 Verifying the integrity of the test tools

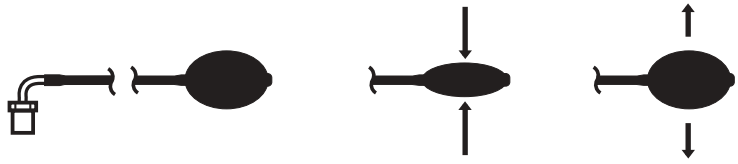
Machine Test Tool
Front View



Back View



1. Verify integrity of low-pressure leak test device.
   - Put your hand on the inlet of the leak test device. Push hard for a good seal.
   - Squeeze the bulb to remove all air from the bulb.
   - If the bulb completely inflates in less than 60 seconds, replace the leak test device.



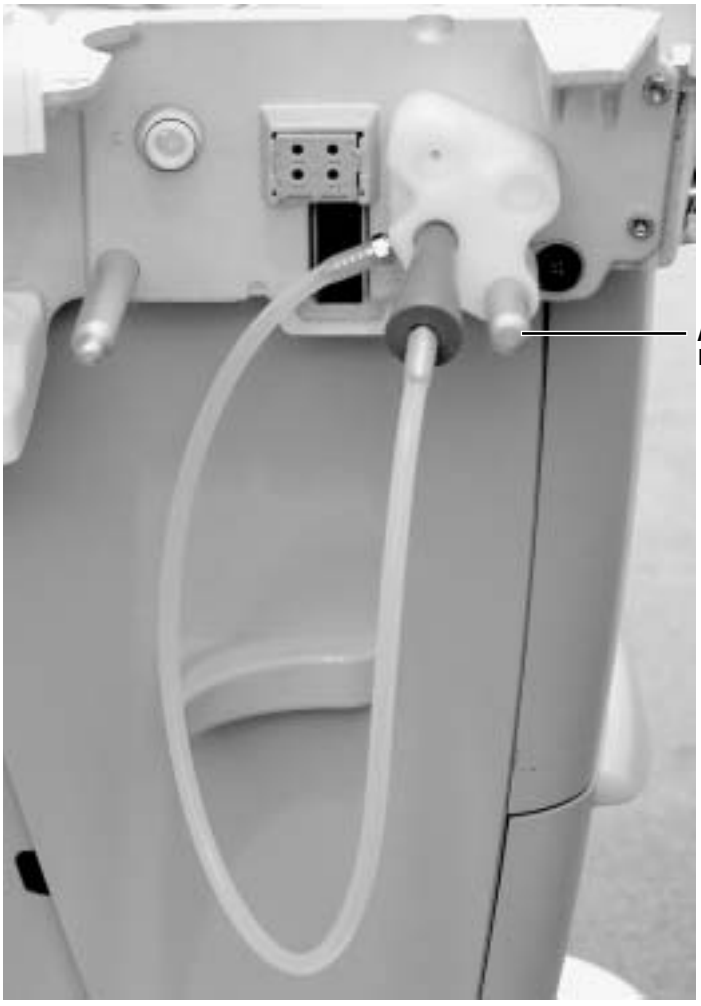
2. Attach the low-pressure leak test device to the Machine Test Tool.
3. Plug the two pressure orifices.
4. Repeatedly squeeze and release the hand bulb until it remains collapsed.
5. If the bulb inflates in less than 30 seconds, locate and correct the leak.

Test 2 Low-pressure leak testing the machine

1. Remove the breathing system from the machine.
2. Attach the Machine Test Tool (using only the Thru Port) and the low-pressure leak test device to **Port 3** of the breathing system interface as shown above.

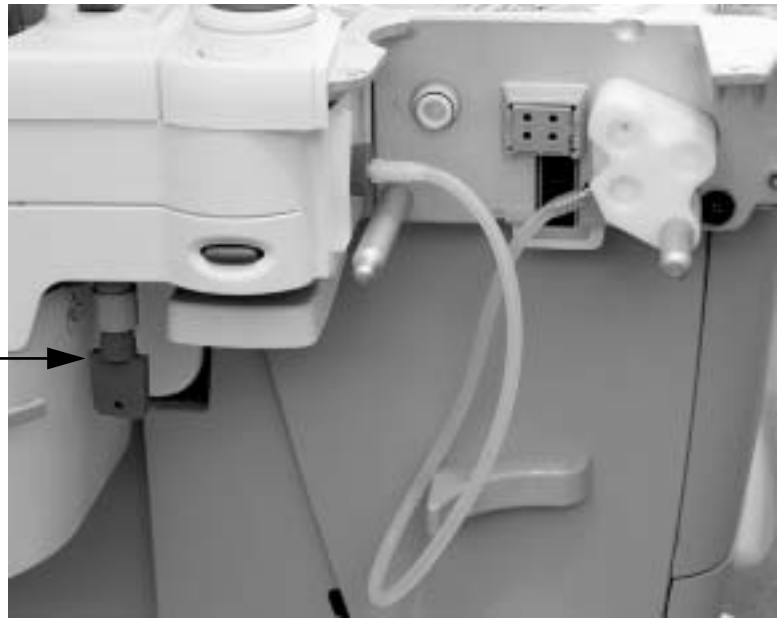
   Note: To prevent damage to the airway pressure gauge, ensure that the gauge port (**Port 1**) is not connected to the Test Tool.
3. Set the ACGO selector switch to ABS.
4. Set the system switch to Standby.
5. Turn off all vaporizers.
6. Open the flow controls one and a half turns counterclockwise.
7. Compress and release the bulb until it is empty.
8. The vacuum causes the floats to move. This is usual. If the bulb completely inflates in 30 seconds or less, there is a leak in the low-pressure circuit.

Test 3 Testing the airway pressure gauge, and Port 1 and Port 3 u-cup seals



1. Attach the Machine Test Tool to the breathing system interface ports (using the alignment post) as shown above.
2. Turn all of the flow controls fully clockwise (minimum flow).
3. Set the system switch to On.
4. Occlude the tapered plug.
   - At minimum flow, the airway pressure gauge reading should increase.
   - If not, there is a leak in the tested circuit.

Test 4 Testing the bag port cover, the APL valve, the Bag/Vent switch, and the negative pressure relief valve



1. Separate the Bellows Module from the Circuit Module and re-install the Bellows Module.
2. Occlude the Bag Port connector.
3. Connect the Machine Test Tool to the interface ports as shown above.
4. Set the Bag /Vent switch to Bag and close the APL Valve (70 cm H_2O).
5. Slowly increase the O_2 flow to achieve 30 cm H_2O.
   - The leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.

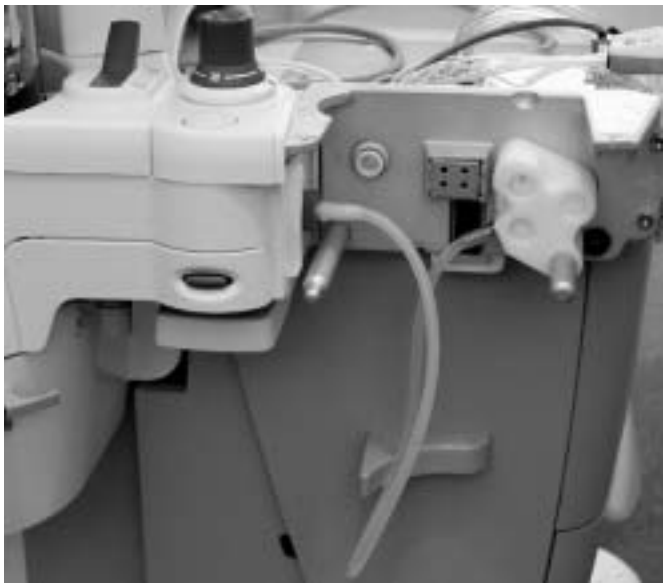
   Note: If the bellows rises, it indicates a leak in the Bag /Vent Switch.

Test 5 Testing the APL diaphram

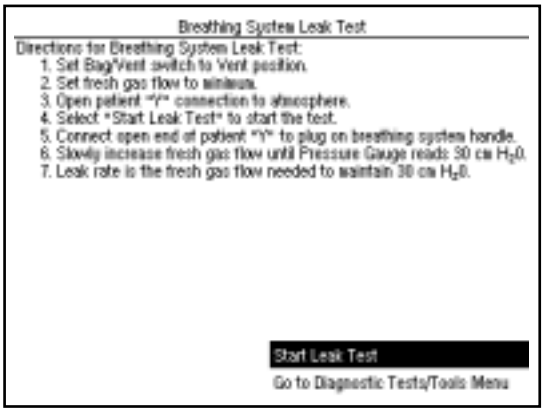
Note If required, set up the Machine Test Tool and breathing system as shown in Test 4.

1. Slide the Bellows Module away from the machine.
2. Remove the APL ramp and diaphragm.
3. Insert a Test Plug into the APL scavenging port, as shown above.
4. Slide the Bellows Module partially back onto the machine casting.
5. Ensure that the Bag Port is plugged and that the Bag/Vent switch is set to Bag.
6. Slowly increase the O_2 flow to achieve 30 cm H_2O.
   - Leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.

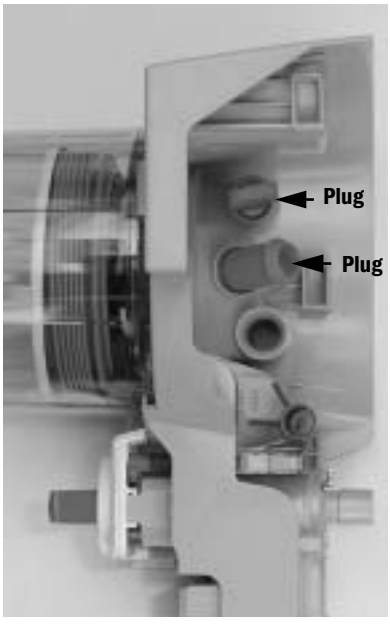
Test 6 Testing the bellows module and the Bag/Vent switch



1. Separate the Bellows Module from the Circuit Module and re-install the Bellows Module.
2. Enter the Service Mode: Push and hold the adjustment knob on the ventilator's display and set the system switch to On.
   a. Select and confirm "Service Modes."
   b. Follow the menu structure outline below to reach the adjustment for the inspiratory flow valve. Select and confirm at each step.
   - "Diagnostics Tests/Tools"
   - "Breathing System Leak Test"
3. Follow the instructions on the screen.
   - At step 5, connect the Machine Test Tool to the interface ports as shown above, instead. Continue with steps 6 and 7 on the screen.
   - The leak rate should be less than 200 mL/min.



Test 7 Testing the bellows, the bellows pop-off valve, the bellows base manifold, and the Bag/Vent switch



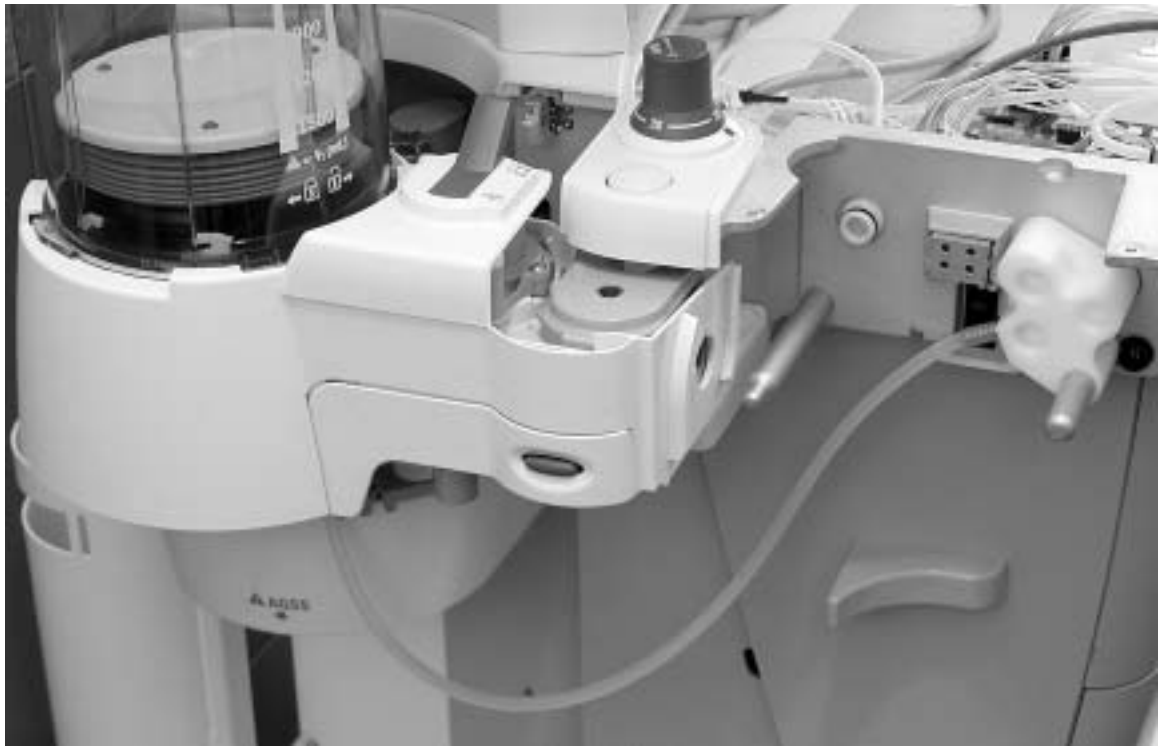
1. Separate the Bellows Module from the Circuit Module.
2. Insert appropriate test plugs into the bellows base manifold as shown to the left.

   Note: Position the bellows assembly so that the bellows remain collapsed as you plug the ports.
3. Set Bag/Vent switch to Vent.
4. Position the bellows upright with the bellows collapsed.
5. Connect the Machine Test Tool to the interface ports as shown above.
6. Slowly increase the O_2 flow to achieve 30 cm H_2O.

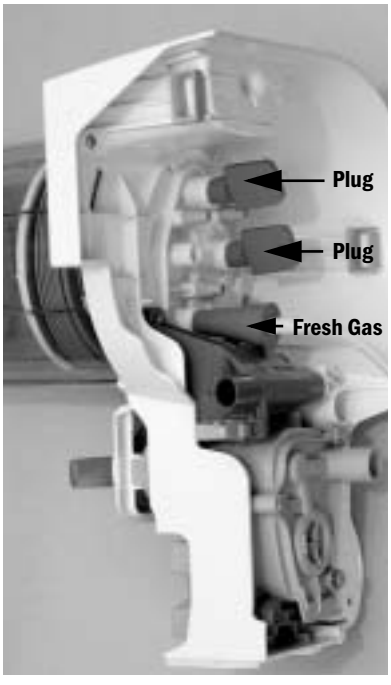
   Note: The bellows will rise until the pressure equalizes.

   - The leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.

Test 8 Testing the bellows assembly



Note If required, set up the Machine Test Tool and breathing system as shown in Test 7.



1. Remove the bellows base manifold from the Bellows Module.
2. Insert appropriate test plugs into the bellows base manifold as shown to the left.

   Note: Position the bellows assembly so that the bellows remain collapsed as you plug the ports.
3. Connect the tapered plug of the Machine Test Tool to the bellows base inlet as shown to the left.
4. Position the bellows upright with the bellows collapsed.
5. Slowly increase the O_2 flow to achieve 30 cm H_2O.

   Note: The bellows will rise until the pressure equalizes.

   - The leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.

Test 9 Testing the flow sensor module, the circuit module, and the soda lime canister

1. Separate the Bellows Module from the Circuit Module and re-install the Circuit/Flow Sensor Module.
2. Connect short tubing between the inhalation and exhalation ports of the breathing system.
3. Insert an appropriate test plug in the outlet port of the Circuit Module.
4. Enter the Service Mode: Push and hold the adjustment knob on the ventilator's display and set the system switch to On.
   a. Select and confirm "Service Modes."
   b. Follow the menu structure outline below to reach the adjustment for the inspiratory flow valve. Select and confirm at each step.
      - "Diagnostics Tests/Tools"
      - "Display A/D Channels"
   c. Record the Inspiratory and Expiratory Flow actual values.

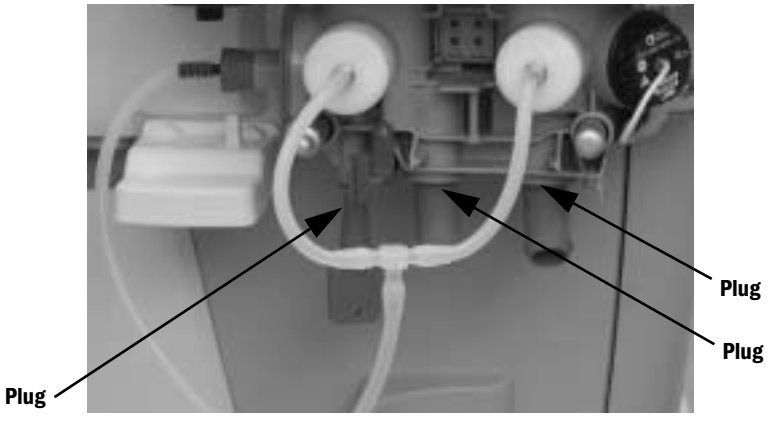
      Note: The Inspiratory and Expiratory Flow actual values should be near zero.
5. Slowly increase the O_2 flow to achieve 30 cm H_2O.
   - The leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.
6. Observe the Inspiratory and Expiratory Flow actual values. The values should be near zero, as previously recorded in step 4.

   Note: If one channel indicates flow, see "Inaccurate Volume Ventilation Troubleshooting" in the 7100 Ventilator Service Manual.
7. Release Pressure.

Test 10 Testing the circuit module and the canister

1. Remove the Flow Sensor module.
2. Connect the Circuit Test Tool to the Circuit Module as shown above.
3. Slowly increase the O_2 flow to achieve 30cmH_2O. The leak rate is equal to the flow required to maintain 30 cmH_2O.
   - The leak rate should be less than 200 mL/min.

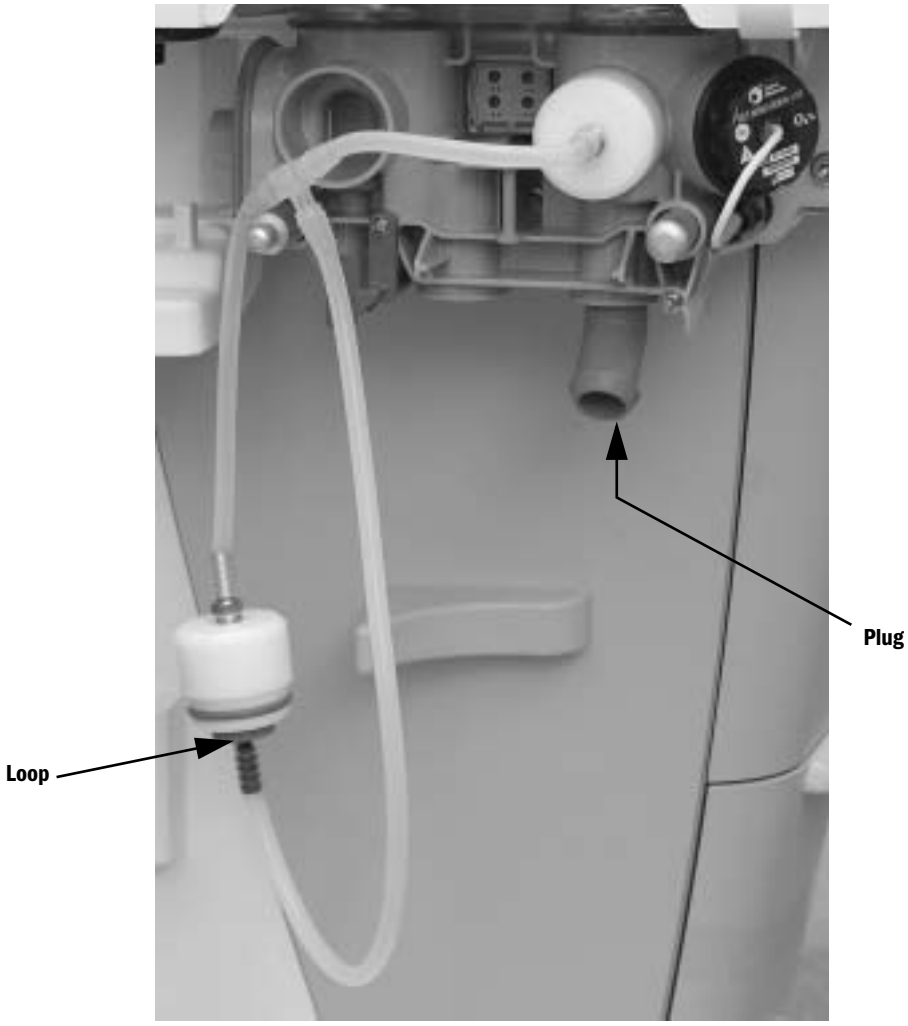
Test 11 Testing the circuit module



Note: If required, set up the machine as in Test 10.

1. Remove the Soda Lime Canister.
2. Using appropriate Test Plugs, plug the three canister ports in the Circuit Module as shown above.
3. Slowly increase the O_2 flow to achieve 30 cm H_2O.
   - The leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.

Test 12 Testing the inspiratory side of the circuit module

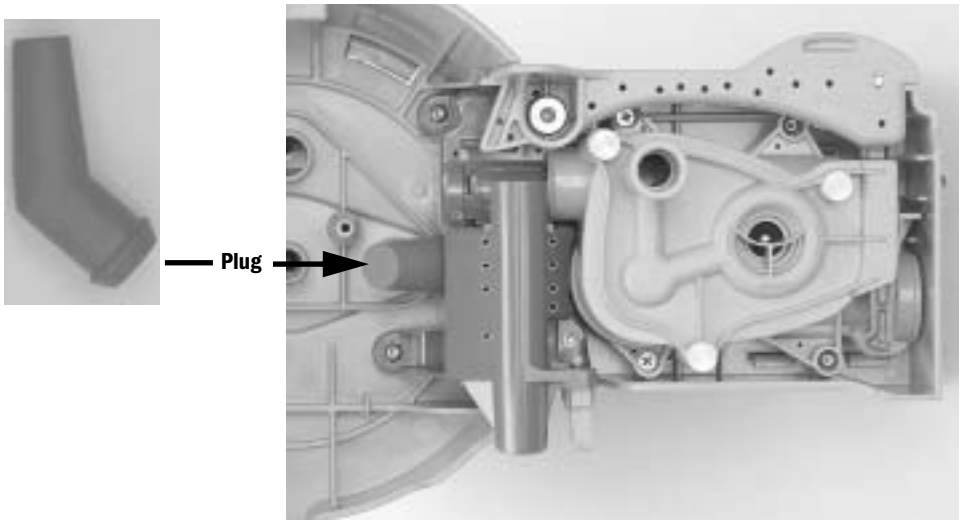


Note: If required, set up the machine as in Test 10 and 11.

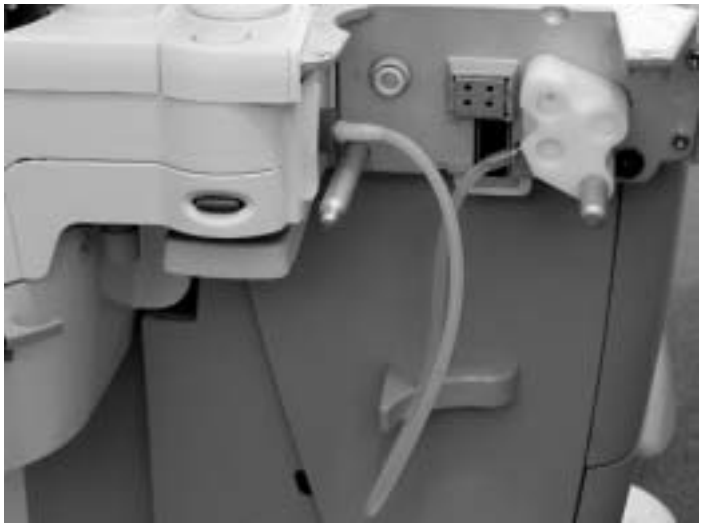
1. Connect the Circuit Test Tool to the Circuit Module as shown above.
2. Insert an appropriate test plug in the inspiratory outlet to the canister as shown above.
3. Slowly increase the O_2 flow to achieve 30 cm H_2O.
   - The leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.

Test 13 Testing the negative pressure relief valve

1. Separate the Bellows Module from the Circuit Module.
2. Remove the Bellows Interface Manifold.
3. Insert test plug (recessed end) into the rear Bag/Vent switch port as shown.

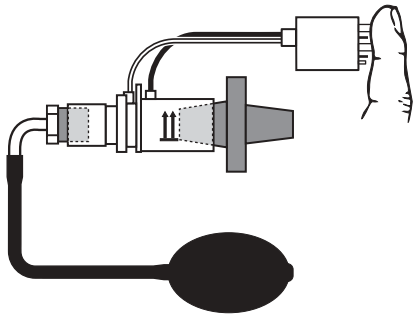


4. Install the Bellows Module.
5. Connect the Machine Test Tool to the interface ports and the Bellows Module as shown above.



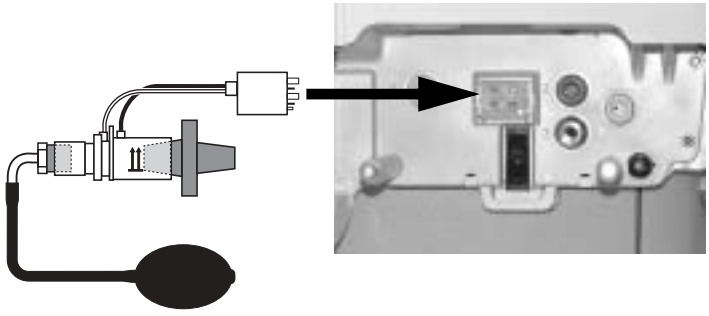
6. Set the Bag/Vent Switch to Vent.
7. Slowly increase the O_2 flow to achieve 30 cm H_2O.
   - The leak rate is equal to the flow needed to maintain 30 cm H_2O.
   - The leak rate should be less than 200 mL/min.

Test 14 Testing the flow sensors only



1. Remove the Flow Sensor Module.
2. Plug each Flow Sensor as shown above.
3. Connect the low-pressure leak test device to the open end of the Flow Sensor.
4. Block the connector end of the Flow Sensor with your hand.
5. Compress and release the bulb until it is empty.
6. If the bulb inflates in 30 seconds or less, there is a leak in the flow sensor.
7. If there are no leaks in the flow sensors, go to Test 15.

Test 15 Testing a flow sensor including the Ventilator Monitoring Assembly and interfacing components



1. Remove Flow Sensors from the Flow Sensor Module.
2. Attach the Flow Sensor to the bulkhead connector.
3. Plug each Flow Sensor as shown.
4. Connect the low-pressure leak test device to the open end of the Flow Sensor.
5. Compress and release the bulb until it is empty.
6. If the bulb inflates in 30 seconds or less, there is a leak. The leak may be through the connector o-rings, in the internal tubbing, or in the Transducer on the VMB.

8 Illustrated Parts

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8.1 Service tools — Anesthesia machine

8.1.1 Test Devices

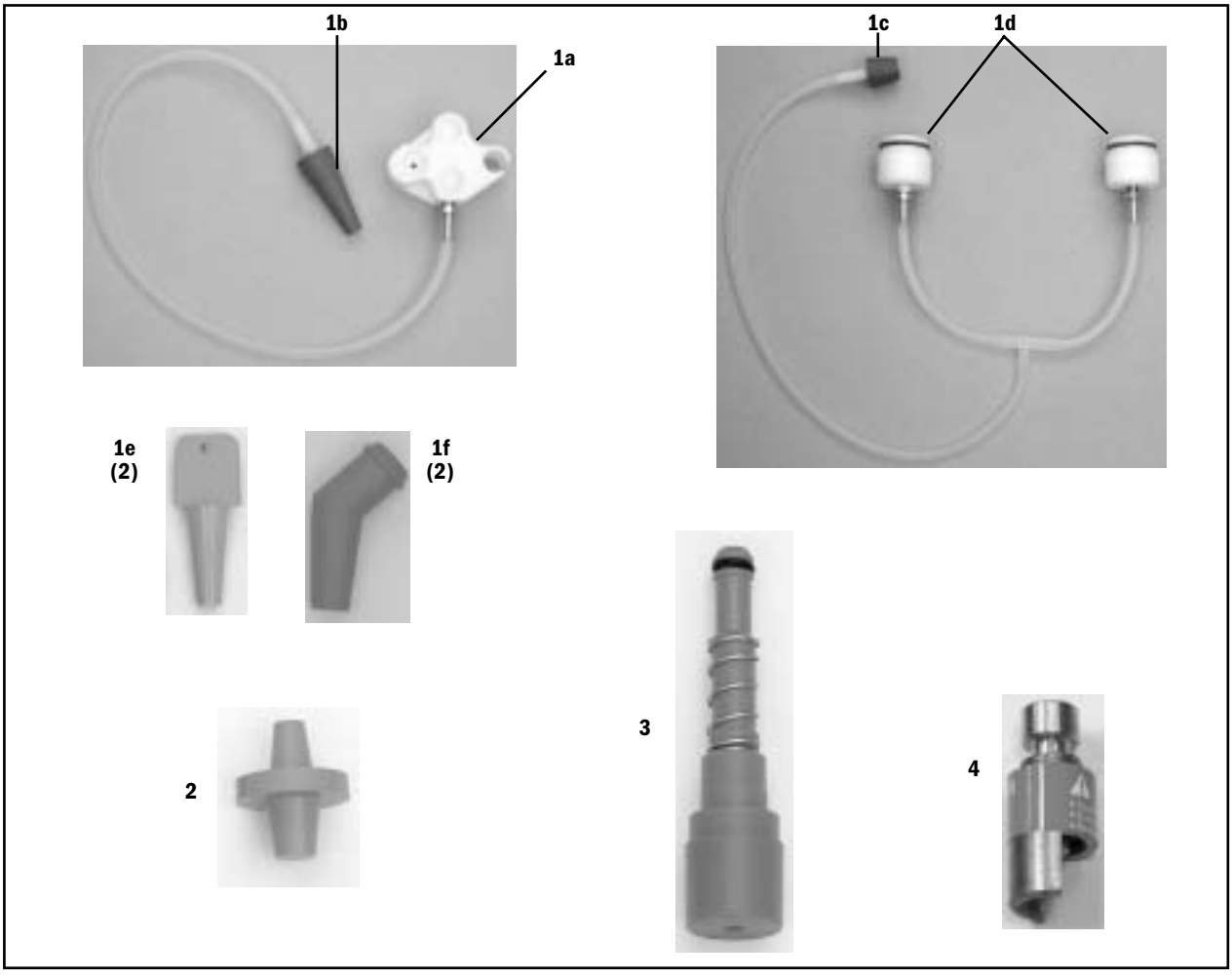
Item	Tool		Stock Number
1	Test flowmeter, 6–50 L/min (Suction Flow Test)		1006-8431-000
Not Shown			
	Low-pressure Leak Test Device	(negative pressure)	0309-1319-800
	Low-pressure Leak Test Device	(positive pressure - ISO)	1001-8976-000
	Low-pressure Leak Test Device	(positive pressure - BSI)	1001-8975-000
	Flow test device capable of measuring 0–15 L/min with an accuracy of ±2% of reading		Refer to section 3.8
	Vacuum test gauge capable of measuring 0 to 550 mm Hg with an accuracy of ±1% of reading		Refer to section 3.9
	Test device capable of measuring 0–30 L/min (see Item 1 above)		Refer to section 3.9
	Leakage current test device		Refer to section 3.11
	Test device capable of measuring 689 kPa (100 psi)		Refer to section 6.1
	Low-pressure test device (digital manometer or test gauge) with an accuracy of ±2% of reading		Refer to section 6.6.2

Test Devices

1

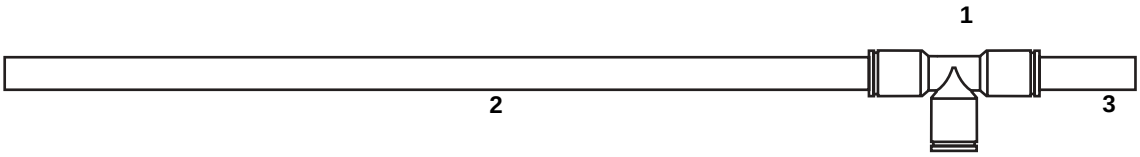
8.1.2 Test Tools

Item	Tool	Stock Number
1	Leak Test Tool Kit, ABS breathing system	1407-7013-000
1a	Test Tool, bulkhead	1407-8500-000
1b	Plug, tapered 27x12 mm	1407-8505-000
1c	Plug, tapered 24x18 mm	1407-8506-000
1d	Test Tool, circle module (2 each)	1407-8502-000
1e	Plug, service B/S 11 mm (2 each)	1407-8504-000
1f	Plug, service BTV 18 mm (2 each)	1407-8503-000
2	Plug, stopper	2900-0001-000
3	Adapter, positive low-pressure leak test	1009-3119-000
4	Vaporizer Manifold Valve Test Tool	1006-3967-000
Not Shown		
	Tool to help disconnect tubing from Legris fittings	2900-0000-000
	Test Lung	0219-7210-300
	Leak detection fluid, Snoop	obtain locally



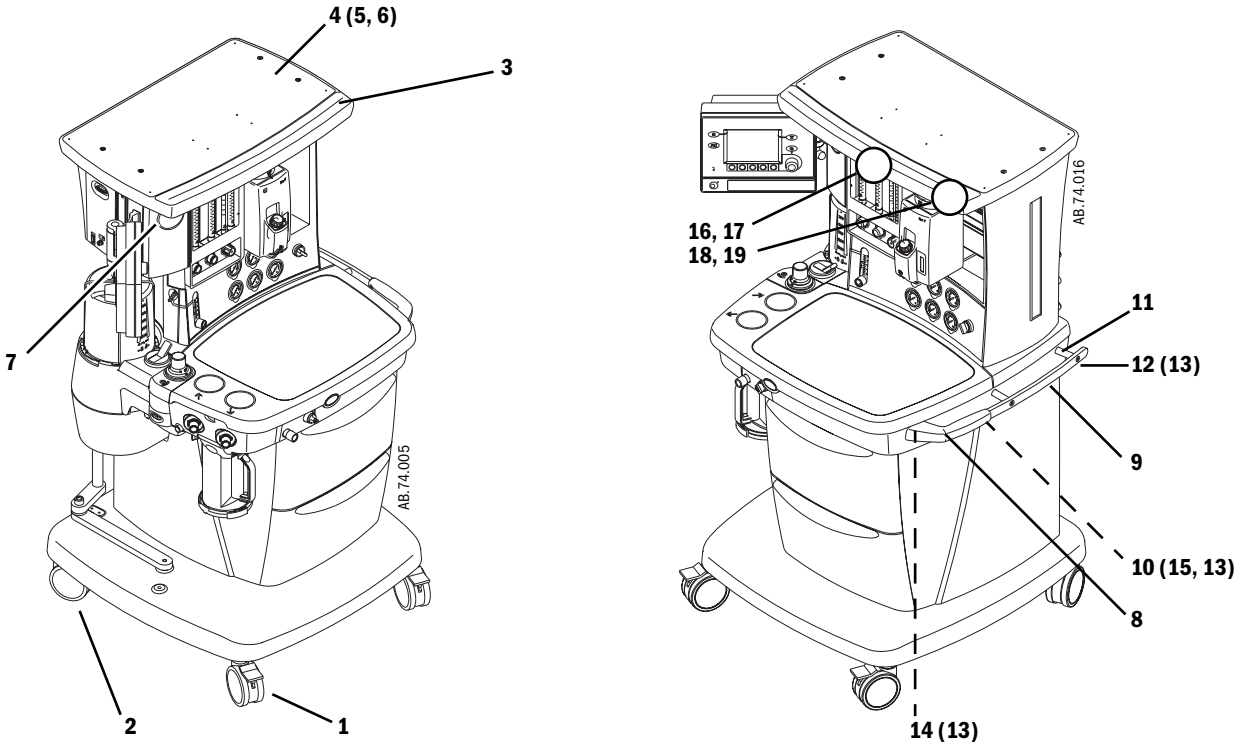
8.1.3 Secondary regulator pilot pressure tool

Assemble the secondary regulator pilot pressure tool using a 4-mm tee and tubing as shown. This tool is used with N_2O needle valve calibration.



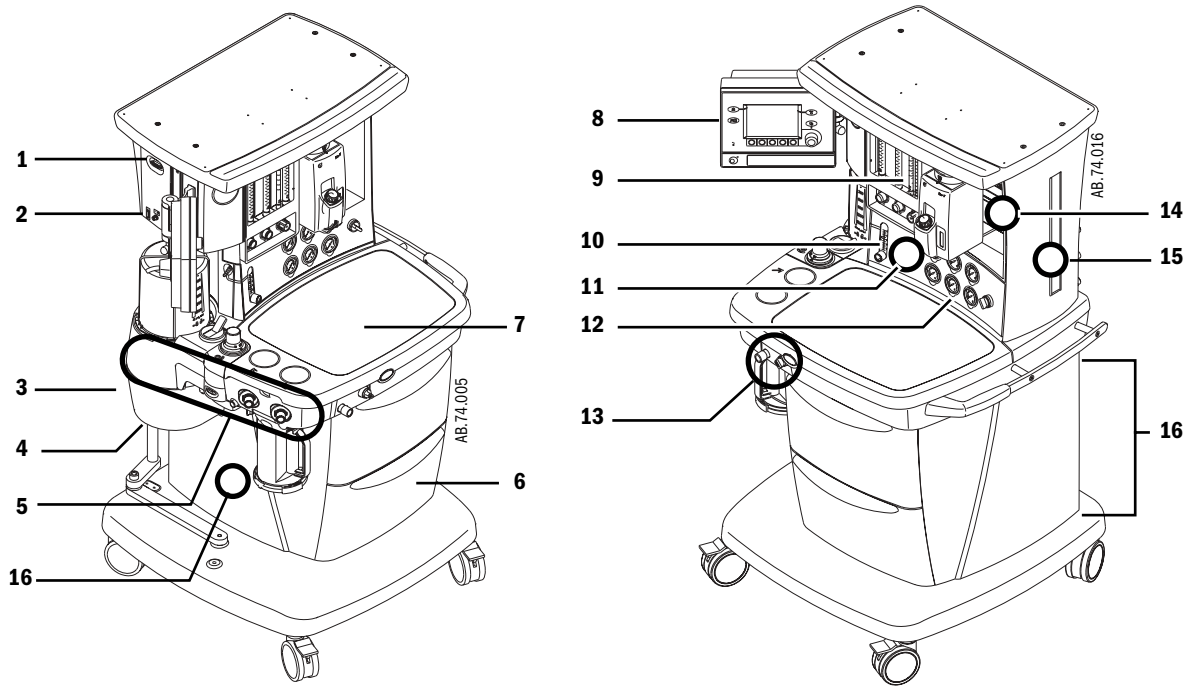
Item	Description	Stock Number
1	Tee, 4 mm, tube/tube/tube	1202-3653-000
2	Tubing, 4 mm (approximately 450 mm - 18 inches)	1001-3060-000
3	Tubing, 4 mm (approximately 50 mm - 2 inches)	1001-3060-000

8.2 External components - front view



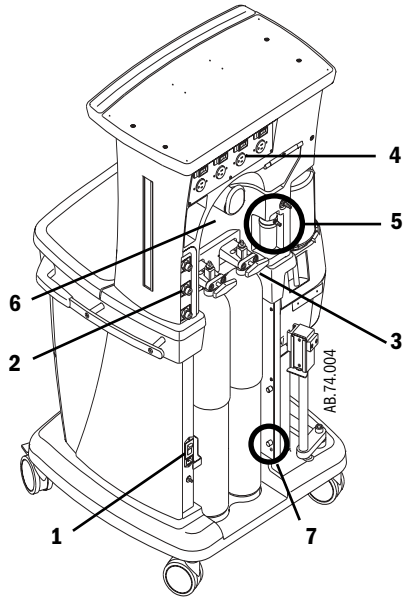
Item	Description	Stock Number
1	Caster, 125-mm with brake (front)	1006-3070-000
2	Caster, 125-mm no brake (rear)	1006-3071-000
3	Cover, cable channel	1009-3020-000
4	Upper shelf	1009-3022-000
5	Bolt, M6x40	0144-2131-911
6	Lockwasher, M6 internal	0144-1118-130
7	Gauge, airway pressure (includes mounting hardware)	1009-3034-000
8	Handle, side	1009-3033-000
9	Handle, Medirail	1009-3101-000
10	Screw, M6x12 Sems	0144-2436-106
11	Spacer	1009-3102-000
12	Screw. M6x70	0144-2131-923
13	Lockwasher M6 external	9213-0560-003
14	Screw, M6x20	0144-2131-921
15	Shim	1009-3131-000
16	Task Light PCB	1009-5504-000
17	Lens, Task Light	1011-3308-000
	Screw	0142-4254-106
18	Switch Assembly, task light	1009-5587-000
19	Plate, switch mounting retainer	1009-3143-000
	Screw	0140-6226-107

8.3 External components - front view references



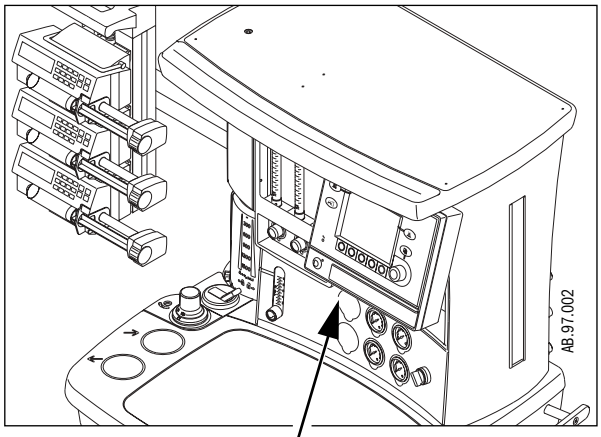
Item	Description	Section number
1	“Serial board”	Refer to section 8.13
2	“AGSS gauge, and sample return”	Refer to section 8.13
3	“Vent Engine Housing”	Refer to section 8.12
4	“Anesthetic Gas Scavenging System — AGSS”	Refer to section 8.29
5	“Breathing System”	Refer to section 8.22
6	“Drawer”	Refer to section 8.23
7	“Tabletop components”	Refer to section 8.9
8	“Display cables” “Display mounts”	Refer to section 8.13 Refer to section 8.32
9	“Flowmeter components”	Refer to section 8.19
10	“Auxiliary O_2 Flowmeter”	Refer to section 8.31
11	“Integrated Suction Regulator”	Refer to section 8.30
12	“Front panel, gauges and system switch”	Refer to section 8.7
13	“ABS to machine Interface Components”	Refer to section 8.20
14	“Vaporizer manifold”	Refer to section 8.18
15	“Right-side Components”	Refer to section 8.10
16	“External components - lower assembly”	Refer to section 8.11

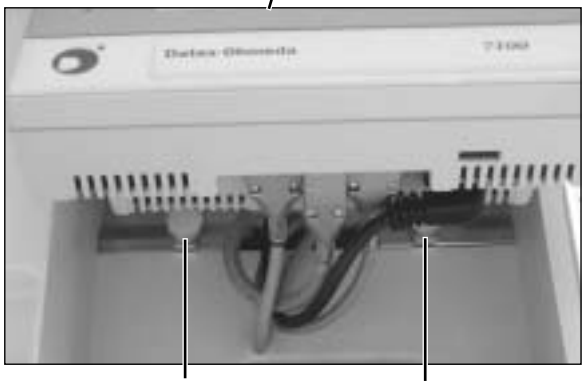
8.4 External Components - rear view

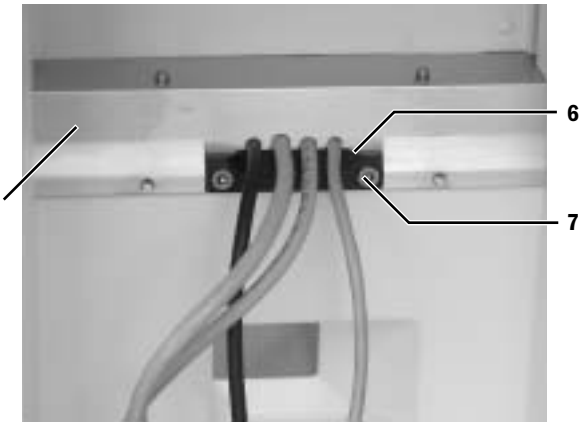


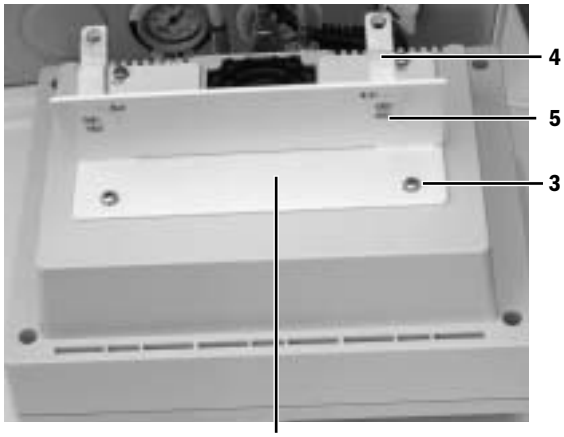
Item	Description	Stock Number
1	AC Inlet	Refer to section 8.14
2	Pipeline Inlets Label, pipeline inlet blank	Refer to section 8.16 1009-3197-000
3	Cylinder Gas Supplies	Refer to section 8.17
4	Electrical Power Outlet Blank panel (no outlets) Screw, M4x12	Refer to section 8.15 1011-3329-000 1009-3109-000
5	Suction items	Refer to section 8.30
6	Rear panel items	Refer to section 8.8
7	Thumbscrew Ring, retainer	1406-3304-000 1406-3319-000

8.5 Control module mounting for a ProTIVA machine







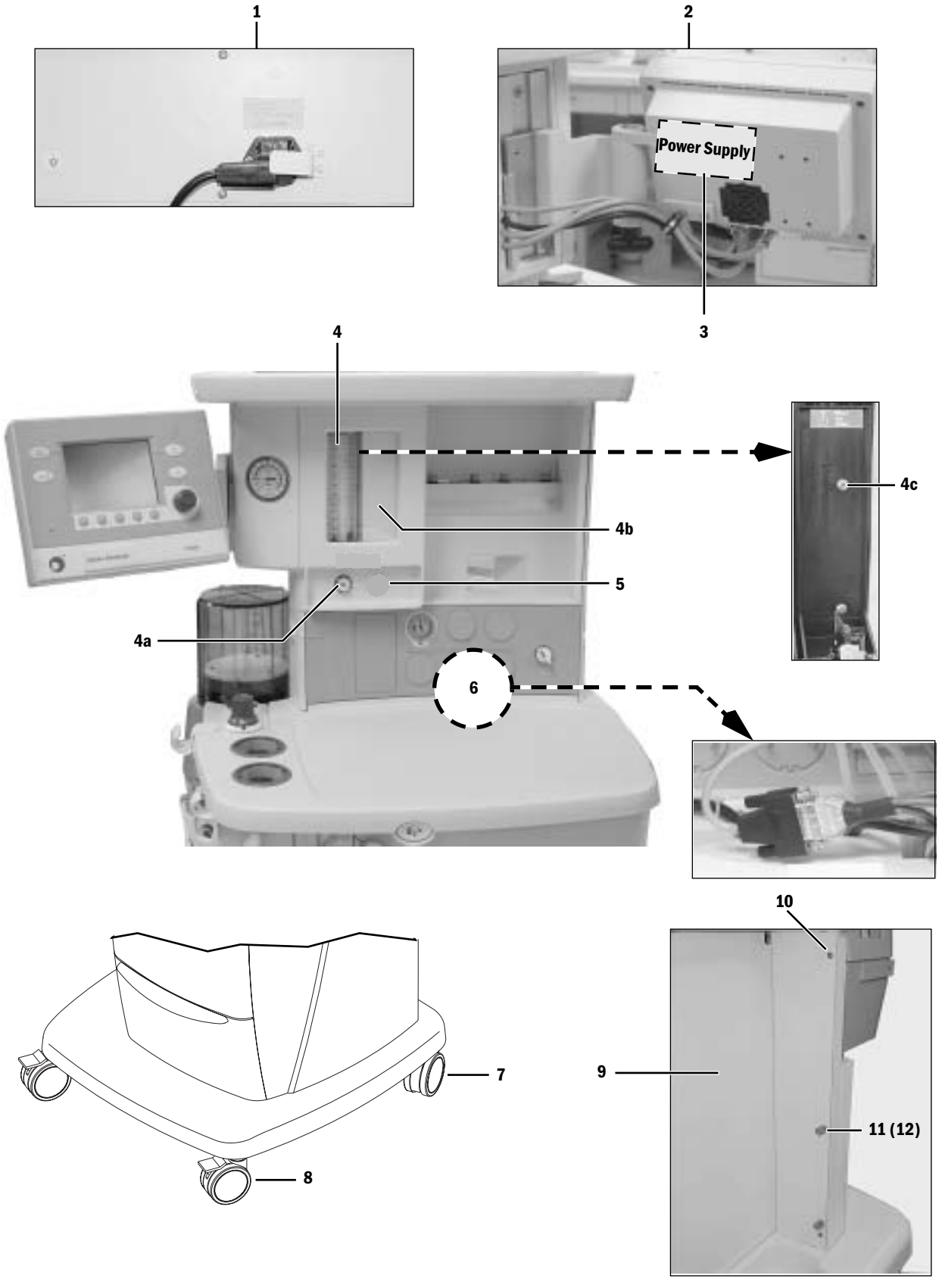


Item	Description	Stock Number
1	Thumbscrew, M6x14	1505-3005-000
2	Bracket, mount 7100 display TIVA	1009-3290-000
3	Screw, M4x12 Pozidriv Lockwasher, M4 external	0140-6226-111 9213-0540-003
4	Block, mount 7100 display TIVA	1009-3294-000
5*	Screw, M4x8 Pozidriv Flat HD	0140-6226-107
6	Clamp, cable TIVA	1009-3291-000
7	Screw, M6x14 SKT HD CAP	0144-2131-922
8	Manifold, display mount TIVA	1009-8232-000

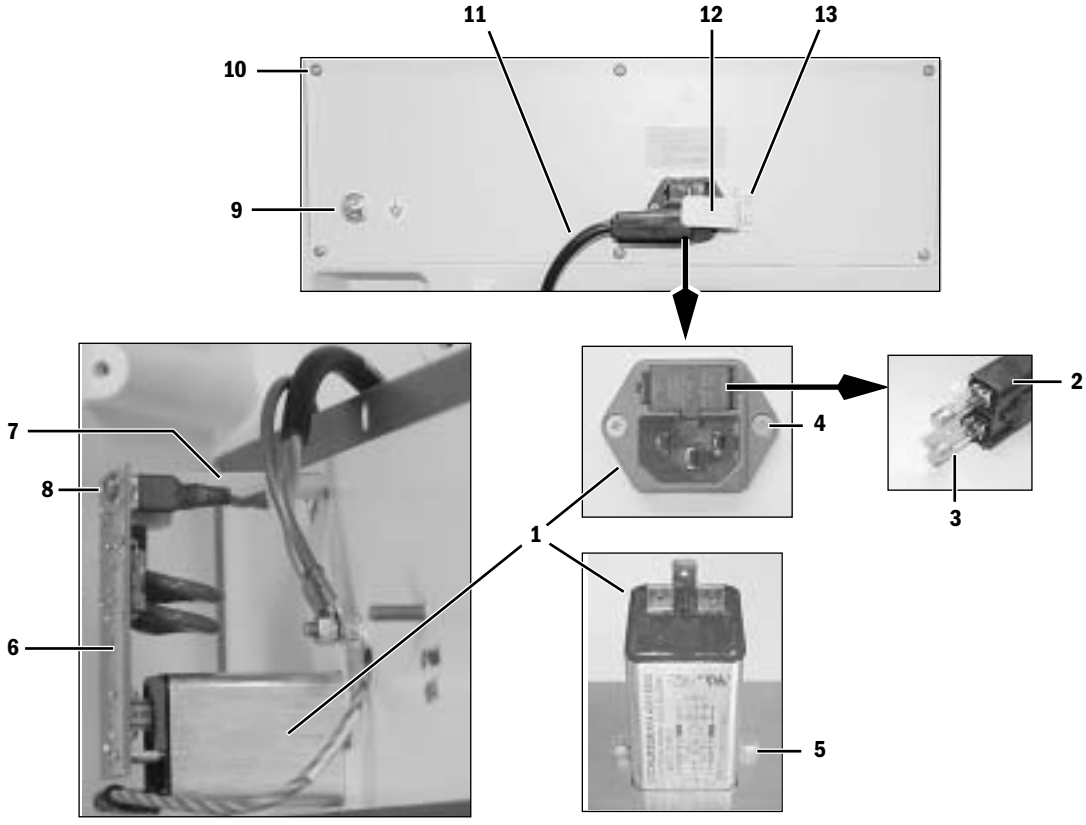
* Apply Loctite 242.

8.6 Aespire 100 - exclusive components

Item	Description	Stock Number
1	AC Inlet	Refer to section 8.6.1
2	Display mount components	Refer to section 8.6.2
3	Power supply, 40W universal (the display/control module in the Aespire 100 uses a different power supply than in a standard Aespire machine)	1609-3040-000
4	Flowhead components (with the following exceptions, all components of the O_2 only flowhead are covered in the "Flowmeter components" section.	Refer to section 8.19
	4a Knob, O_2 (does not include label)	1006-3634-000
	4b Plate, flowtube blank	1006-1506-000
	4c Screw, tread forming 0.88 inch (this screw is slightly longer to compensate for the flowtube blank plate)	1009-3410-000
5	Blank Label Set (when replacing the flowmeter bezel, use appropriate label to cover unused flow control positions)	1009-3409-000
6	Harnesses	Refer to section 8.28
7	Caster, non-locking 4-inch	1009-3038-000
8	Caster, locking 4-inch	1009-3039-000
9	Panel, lower rear cover	1009-3407-000
10	Screw, M4x8	1006-3178-000
11	Thumbscrew	1406-3304-000
12	Ring, retaining	1406-3319-000

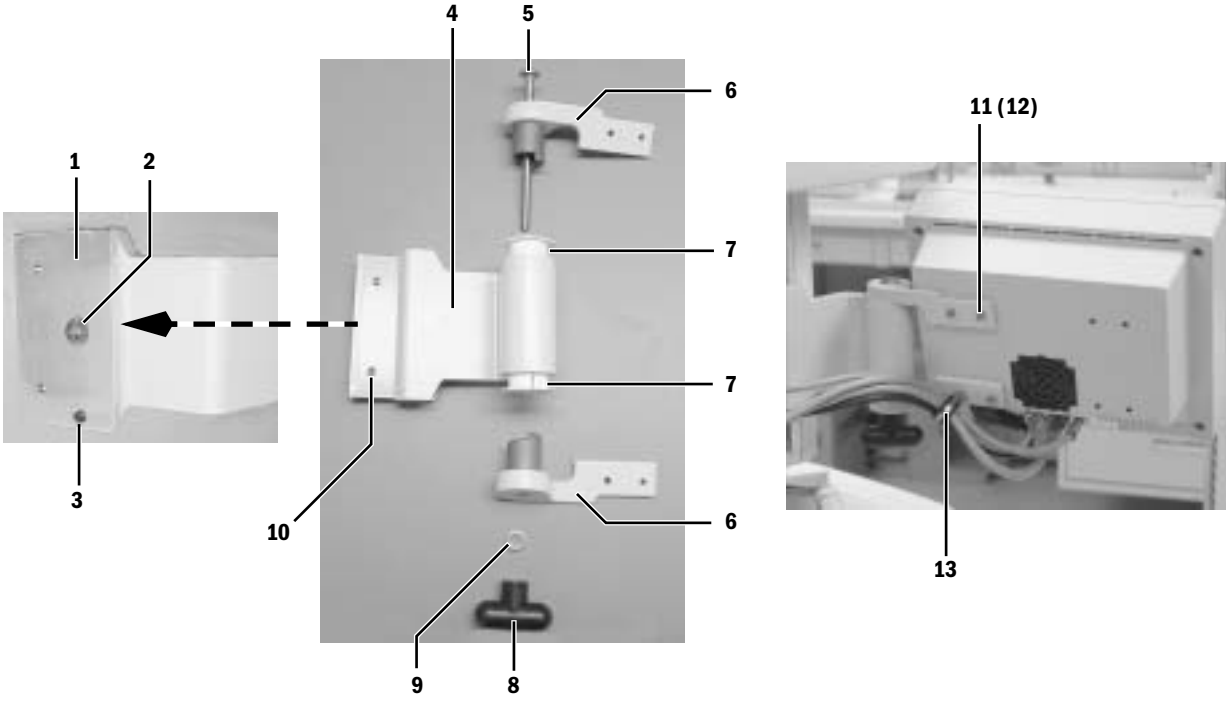

1
2
Power Supply
3
4
4c
4b
5
4a
6
10
9
11 (12)
7
8

8.6.1 AC Inlet (Aespire 100)



Item	Description	Stock Number
1	AC Inlet, with line filter	1609-3019-000
2	Fuse drawer	1609-3020-000
3	Fuse, 2A	1009-5778-000
4	Screw, M3x8	9211-0530-083
5	Nut, M3 Keps	0144-3717-302
6	Transient Suppression board	1609-3101-000
7	Standoff, 52-mm Long	1609-3320-000
8	Screw, M4x8	0140-6226-113
9	Stud, Equal Potential, 6-mm	0208-0070-300
10	Screw, M4x12	1009-3109-000
11	Power Cord	Refer to section 8.14
12	Clamp, power cord retainer	1009-3405-000
13	Screw, M4x8	1006-3178-000

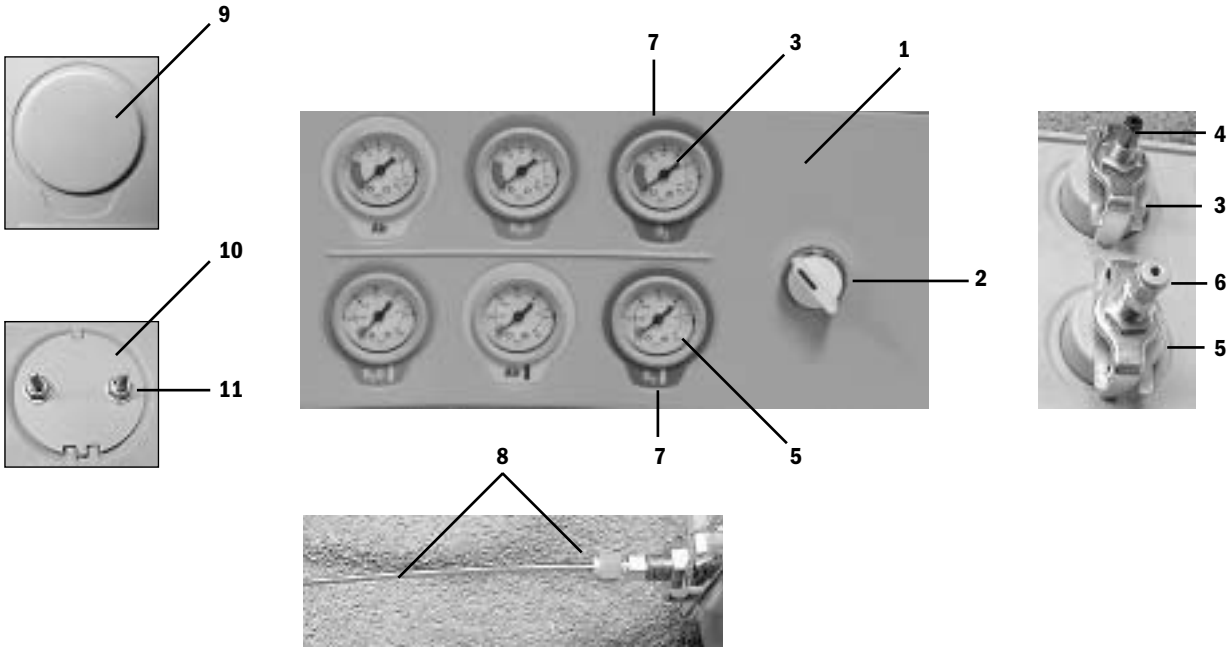
8.6.2 Display mount (Aespire 100)



Item	Description	Stock Number
1	Dovetail insert	1009-3408-000
2*	Screw, M8x20 SKT HD	0144-2440-821
3*	Screw, M6x12 SKT HD	0144-2436-101
4	Extrusion, Vent bracket mount	1504-3514-000
5	Bolt, carriage	1006-1433-000
6	Casting, Vent Bracket, 20 degree (2)	1504-3526-000
7	Bearing, white plastic (2)	1006-3228-000
8	Handle, T-clamping	1301-3001-000
9	Washer, flat	9213-0180-006
10	Set screw, M6x10	0141-4227-111
11	Screw, M4x16	9211-0440-163
12	Lockwasher, M4	0144-1118-128
13	Clamp	1504-3527-000

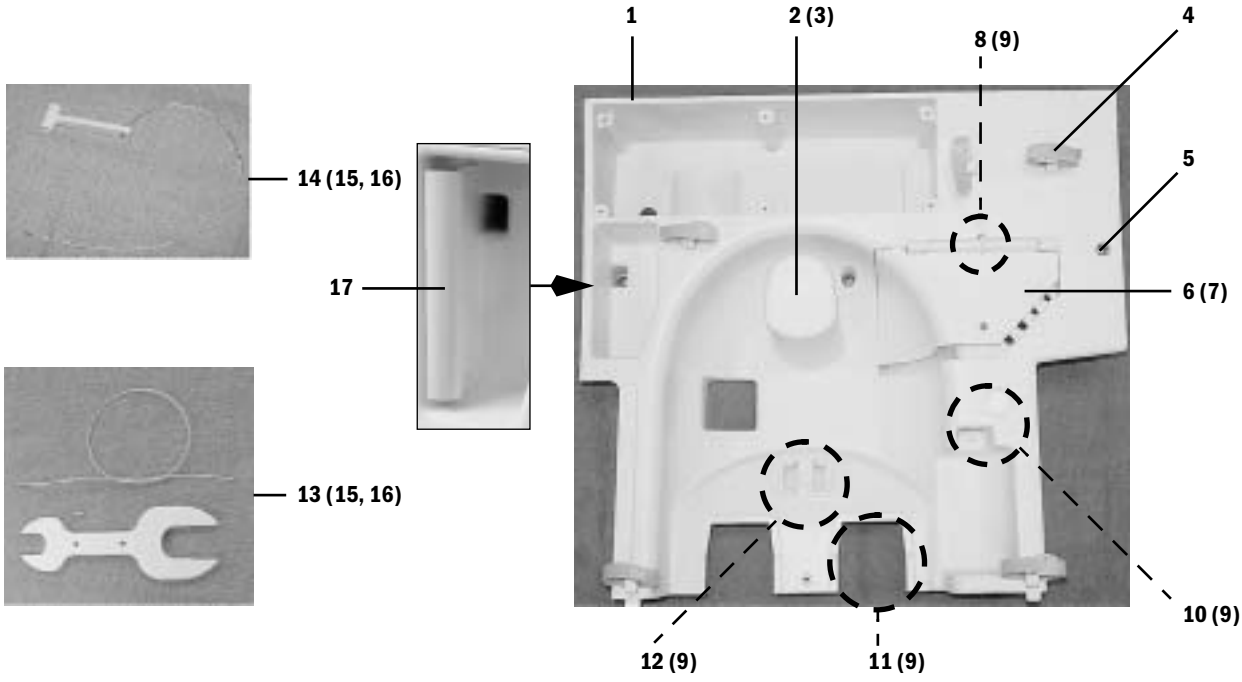
* Apply Loctite 242

8.7 Front panel, gauges and system switch



Item	Description	Stock Number	Stock Number (pipeline)	Stock Number (cylinder)
1	Panel, gauge front	1009-3018-000		
2	Switch, D-O system	1006-8452-000		
3	Gauge, low pressure (includes mounting hardware)		1009-3079-000	
4	Connector, 1/8 inch Legris to 10-32		1006-3711-000	
5	Gauge, high pressure (includes mounting hardware)			1009-3080-000
6	Connector, 1/8 inch copper tube to 5/16-24			1006-3712-000
7	Label, gauge	O_2 ANSI	1009-3081-000	1009-3199-000
		N_2O ANSI	1009-3082-000	1009-3201-000
		Air ANSI	1009-3083-000	1009-3200-000
		O_2 ISO	1009-3202-000	1009-3204-000
		N_2O ISO	1009-3082-000	1009-3201-000
		Air ISO	1009-3203-000	1009-3205-000
		O_2 Neutral	1009-3234-000	1009-3237-000
		N_2O Neutral	1009-3235-000	1009-3238-000
		Air Neutral	1009-3236-000	1009-3239-000
8	Tube Kit, copper tube and fittings (inboard cylinder)	1006-8371-000		
	Tube Kit, copper tube and fittings (3rd gas)	1006-8372-000		
9	Plate, gauge blanking	1009-3045-000		
10	Plate, gauge blank backing	1009-3147-000		
11	Palnut	1009-3090-000		

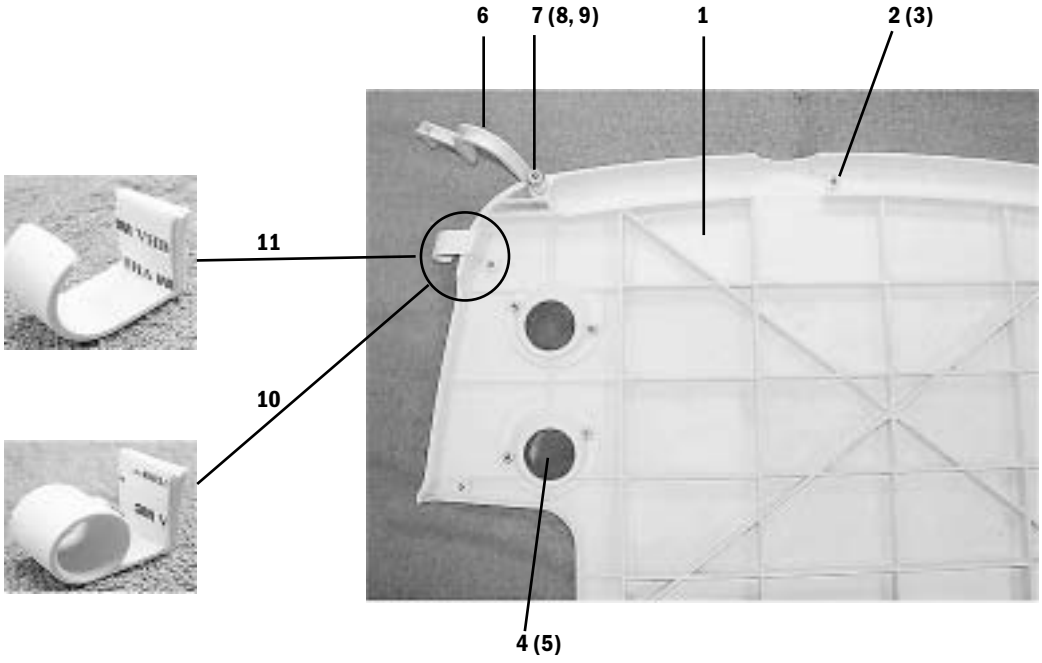
8.8 Rear panel components



Item	Description	Stock Number
1	Cover, rear upper	1009-3073-000
2	Cap, hose reel	1009-3075-000
3	Screw, M5.5x20	1009-3384-000
4	Strap, hook/loop	1009-3233-000
5	Screw, M6x1.0 captive	1009-3114-000
6	Door, access (not functional for Aespire)	1009-3074-000
7	Screw, M4x12	1009-3109-000
8	Spring, cantilever	1009-3124-000
9	Screw, M3x8	0142-4254-106
10	Cover, trap bottle (if no internal suction)	1009-3173-000
11	Cover, regulator yoke (if no regulator)	1009-3121-000
12	Plate, clip cover	1009-3185-000
13	Wrench, DIN cylinder (with cable)	1202-3651-000
14	Wrench, pin index cylinder (with cable)	0219-3415-800
15	Cable	1010-3049-000
16	Ferrule, cylinder wrench cable retainer	1001-3708-000
17*	Handle, P-grip	1009-3343-000

* Clean mounting surface with isopropyl alcohol.

8.9 Tabletop components

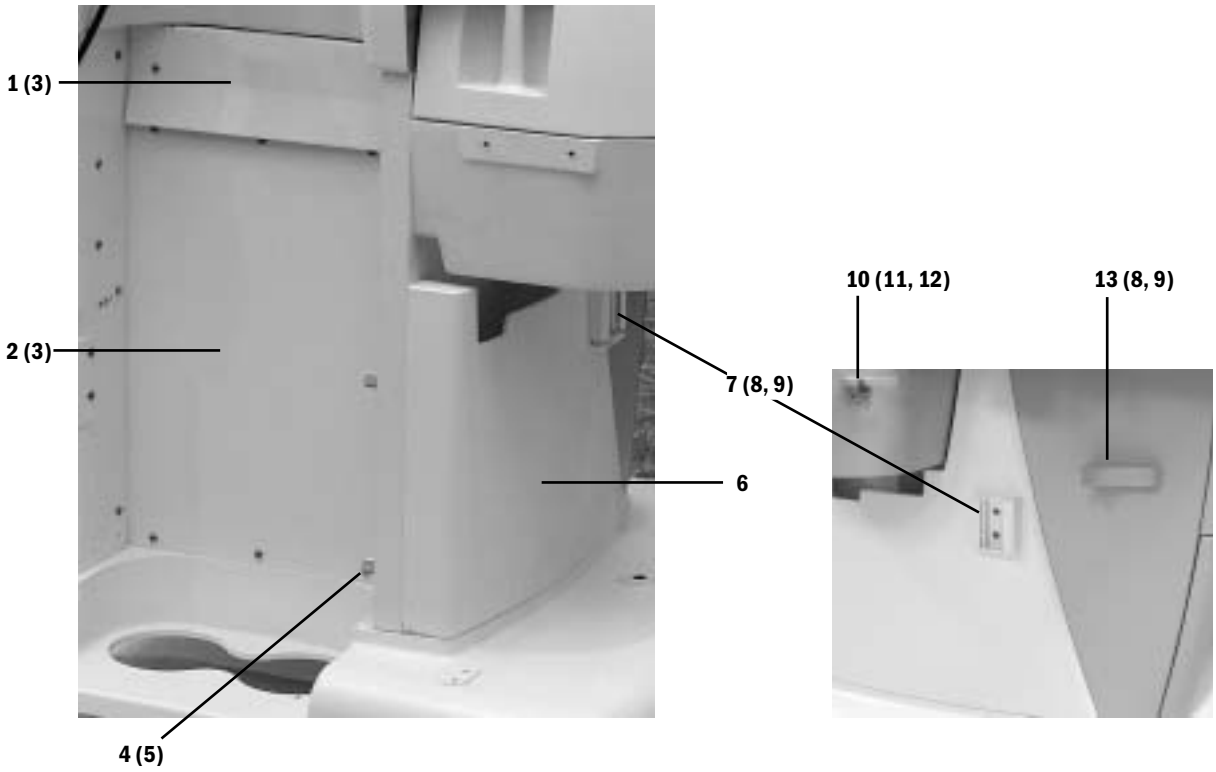


Item	Description	Stock Number
1	Tabletop, work surface	1009-3029-000
2	Screw, relieved	1504-3001-000
3	Washer, retainer	1009-3178-000
4	Window, check-valve	1009-3088-000
5	Palnut	1009-3090-000
6	Hook, breathing circuit	1009-3086-000
7	Bolt, shoulder	1009-3172-000
8	Washer, wave	1009-3035-000
9	Washer, Nylon	1009-3150-000
10	Clip, with tape (used with bag arm)	1009-8196-000
11	Clip, with tape (used with bag on hose)	1009-8197-000

8.10 Right-side Components

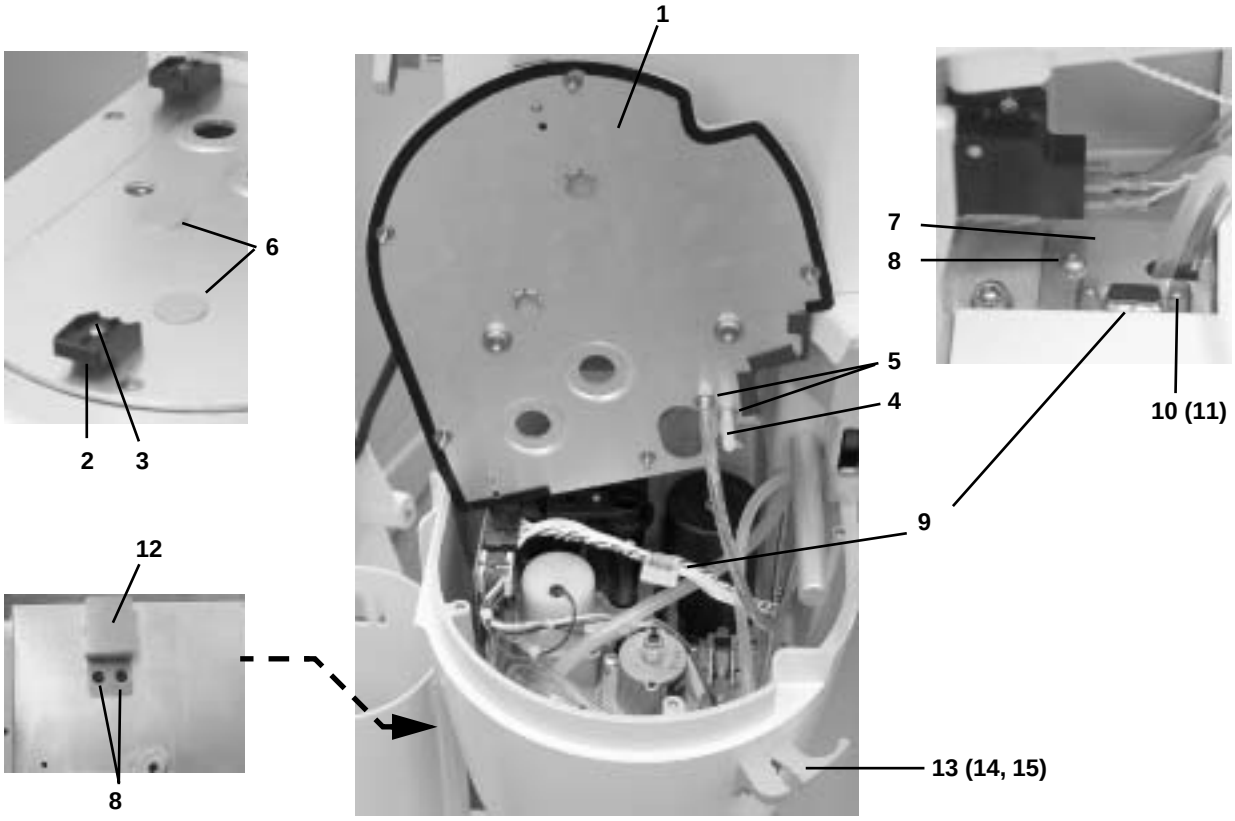
Item	Description	Stock Number
1	Extrusion cover	1009-3021-000
2	Screw, M6x20	0144-2131-921
3	Lockwasher, M6 internal	0144-1118-130
4	Dovetail, RH upright	1009-3129-000
5	Screw, M4x10 self-tapping	1009-5534-000
6	Cover, pipeline inlet	1009-3091-000
7	Screw, M4x8	1006-3178-000

8.11 External components - lower assembly



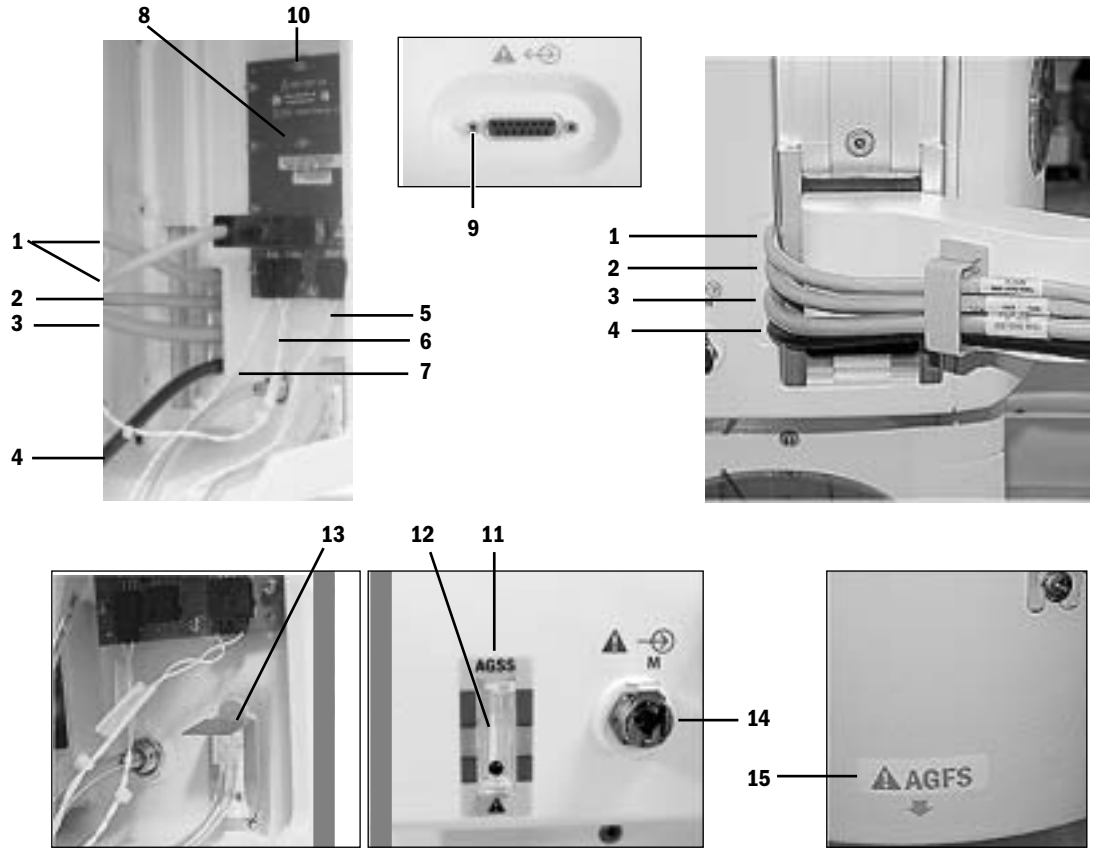
Item	Description	Stock Number
1	Panel, access	1009-3059-000
2	Panel, service	1009-4141-000
3	Screw, M4x8	1006-3178-000
4	Thumbscrew	1406-3304-000
5	Ring, retaining	1406-3319-000
6	Cover, scavenger reservoir	1009-3027-000
7	Bracket, suction reservoir	1009-3107-000
8	Screw, M4x16	9211-0440-163
9	Lockwasher, M4 external	9213-0540-003
10	Clip, suction bag hose	1407-3327-000
11	Screw, M5x16 PAN HD	9211-8350-163
12	Lockwasher, M5 external;	0144-1118-220
13	Bumper, absorber	1009-3105-000

8.12 Vent Engine Housing



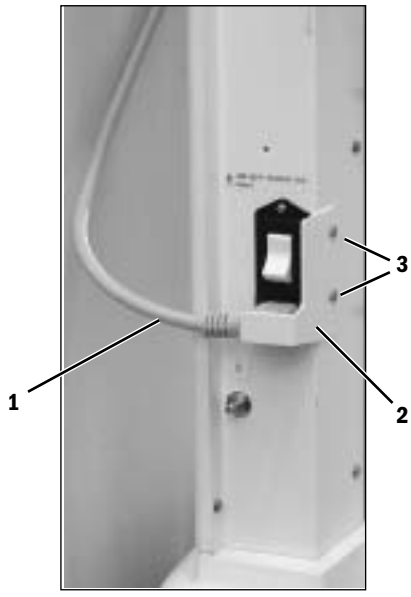
Item	Description	Stock Number	Qty
1	Vent Engine Cover Plate Assy	1407-7009-000	
2	TAB GUIDE BELLOWS BASE	1407-3313-000	(2)
3	SCR M3X16 POSI DR PAN HD A4 SST	1504-3003-000	(2)
4	Cap, Plug	1406-3524-000	
5	FITTING PNL MOUNT 3.18 HOSE BARB UNION	1504-3014-000	(2)
6	PLUG HOLE 15.9 DIA NYLON MICRO PLASTICS	1006-1473-000	
7	PLATE CONN VENT	1407-3321-000	
8	SCR M4X8 POZI-DR DIN84 PAN SERRATED	1006-3178-000	(5)
9	HARN VENT ENG BRD TO COIN SLOT	1009-5545-000	
10	BLOCK LATCHING DSUB CONN	1504-3617-000	(2)
11	SCR 4-40 X 3/8 SKT BCG HD CAP	0144-2117-206	(2)
12	Bracket, scavenging guard in machines without scavenging	1407-3922-000	
13	CLIP-SUCTION BAG HOSE	1407-3327-000	
14	SCR M5 X 16 PAN PH HD SST	9211-8350-163	(2)
15	Lockwasher	0144-1118-220	(2)

8.13 Display cables, serial board, AGSS flowtube, and sample return

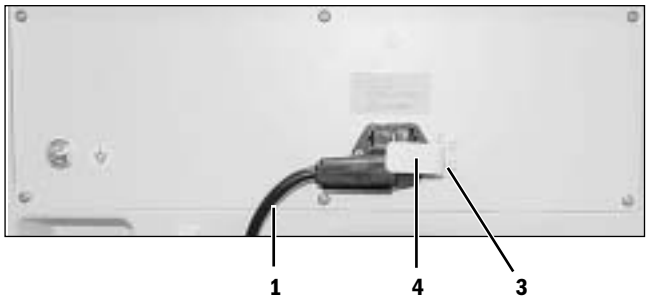


Item	Description	Stock Number
1	CABLE SER ISLN CONN BRD TO CTRL MOD 7100	1009-5691-000
2	CABLE MONITORING BOARD	1504-5604-000
3	CABLE PNEUMATIC ENGINE	1504-5605-000
4	Cable, power	1009-5711-000
5	“Harness, Serial ISO to O2 flush SW”	1009-5567-000
6	“Harness, Serial ISO to O2 supply SW”	1009-5568-000
7	“Harness, Serial ISO to on/ standby SW”	1009-5566-000
8	Serial Isolation Board	1009-5500-000
9	Standoff	1202-3092-000
	Lockwasher	0144-1104-331
10	Screw, thread forming	1009-3400-000
11	Label, flow indicator AGSS	1406-3527-000
	Label, flow indicator AGFS (for German variant)	1009-3301-000
	Label, blank (for machines without flow indicator)	1009-3241-000
12	Flowtube, AGSS	1406-3560-000
13	Clip, AGSS flowtube	1009-3181-000
14	Coupling, Colder (Kit includes mounting nut)	1009-8321-000
	Label set, blank (for machines without scavenging)	1009-3351-000
15	Label, AGFS (for German variant)	1009-3300-000

8.14 AC Power cords



Aespire 100 machine

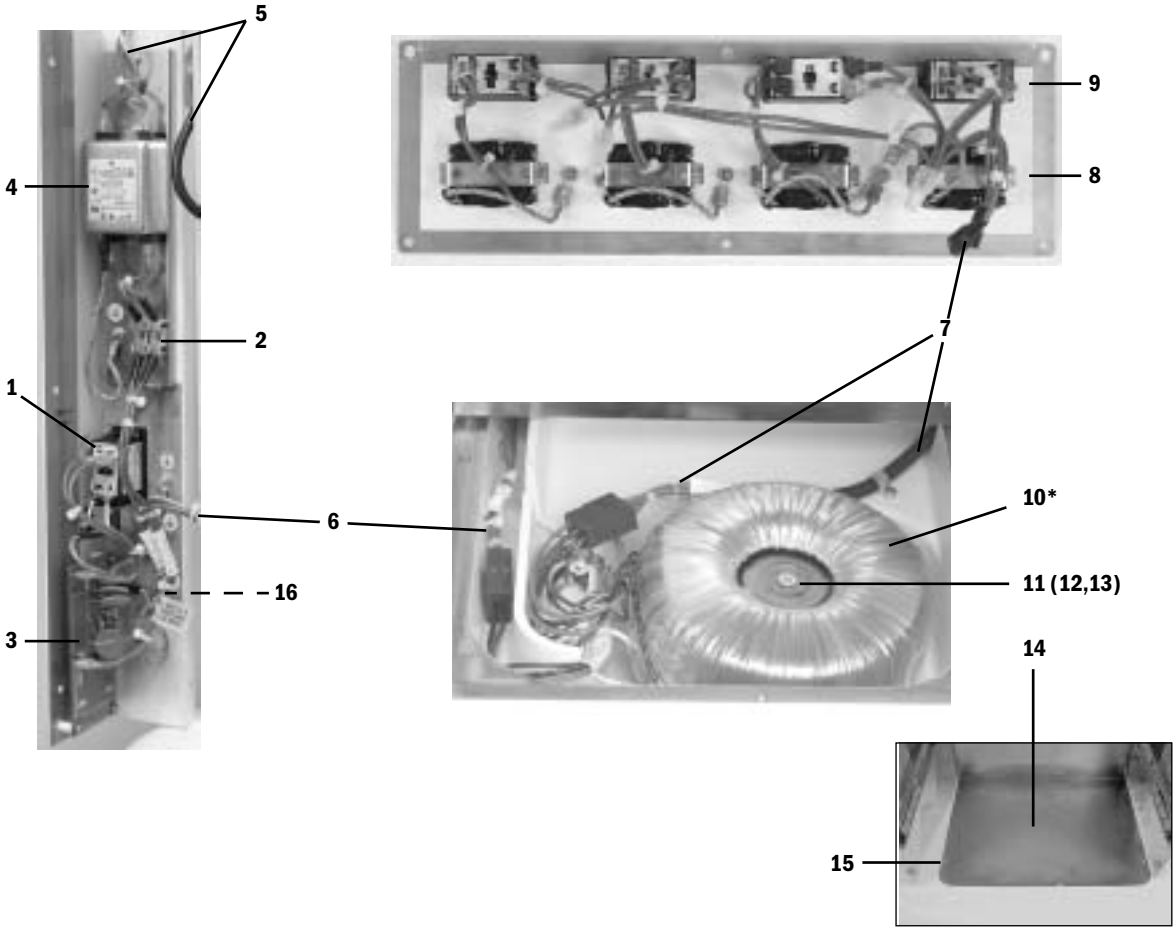


Item	Description	Stock Number
1	Power Cord	
	Australia and China, 220-240 VAC AS 3112 outlets	1006-3888-000
	EURO and France, 220 VAC with CEE 7/7	1001-3380-000
	India and South Africa, 220-240 VAC BS546	1006-3885-000
	Japan and US, 100-120 VAC NEMA	1006-3907-000
	Peru, 220-240 VAC NEMA	1006-3882-000
	Swiss, 220-240 VAC SEV 1011	1006-3889-000
	UK, 220-240 VAC BS1363	1006-3884-000
2	Clamp, power cord retainer	1009-3103-000
3	Screw, M4x8 PAN serrated	1006-3178-000
4	Clamp, power cord retainer	1009-3405-000

8.15 AC Inlet/Outlet Components

Item	Description	Stock Number
1	Inlet, 100/120 AC, with line filter and 15 A circuit breaker	1009-5698-000
	Inlet, 220/240 AC, with line filter and 8 A circuit breaker	1009-5757-000
2	Fuse, 2A - 5x20mm	1009-5778-000
	Fuse holder	1009-5674-000
3	Circuit board, Inrush, 100-120V	1006-3245-000
	Circuit board, Inrush, 220-240V	1006-3246-000
	Circuit board, Transient Suppression, 100-120V	1006-3788-000
	Circuit board, Transient Suppression, 220-240V	1006-3789-000
4	Filter, AC Line, 100-240V	1009-5675-000
5	Cable, line filter to Display Module	1009-5711-000
6	Harness, 100/120 V to Toroid (or to outlets harness)	1009-5713-000
	Harness, 220/240 V to Toroid (or to outlets harness)	1009-5714-000
	Harness, if no outlets	1009-5715-000
7	Harness, to 100/120 V outlets	1009-5716-000
	Harness, to 220/240 V outlets	1009-5717-000
8	Outlet Receptacle, Australia, AS 3112	1001-3305-000
	Outlet Receptacle, EURO, CEE 7/7	1202-3551-000
	Outlet Receptacle, France, CEE 7/4	1006-4421-000
	Support Frame, snap in	1006-4422-000
	Outlet Receptacle, India and South Africa, BS 546	1006-3805-000
	Outlet Receptacle, Japanese	1006-3578-000
	Outlet Receptacle, NA, Nema 5-15	1006-3555-000
	Outlet Receptacle, Swiss, SEV 1011	1006-3807-000
	Outlet Receptacle, UK, BS1363	1001-3309-000
9	Circuit Breaker, 1A, Rocker	1009-5722-000
	Circuit Breaker, 2A Rocker	1009-5721-000
	Circuit Breaker, 3A Rocker	1009-5720-000
	Circuit Breaker, 4A Rocker	1009-5719-000
10*	Toroid, 100-240V	1009-5692-000
	Heatshrink tubing	1202-3268-000
11	Screw, M6x70	0144-2131-923
12	Lockwasher, M6	9213-0560-003
13	Washer	0402-1107-500
14	Cover, transformer	1009-3063-000
15	Screw, M4x8 DIN84 (for transformer cover)	1006-3178-000
16	Stud, Equal Potential, 6 mm	0208-0070-300

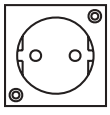
* Apply heatshrink tubing to terminals of black and white wires if not being used.



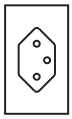
AS 3112
Australia/China

AA.96.228

Nema 5-15
Japanese

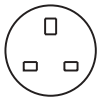


CEE 7/7
EURO



SEV 1011
Swiss,

CEE 7/4
France

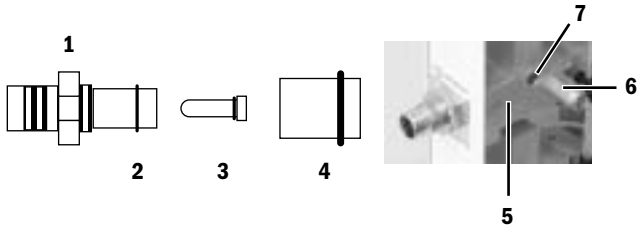


BS1363
UK

BS 546
India and South Africa

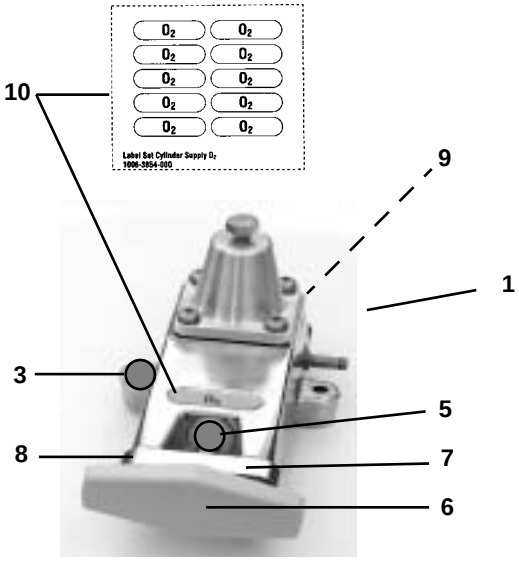
Nema 5-15
NA

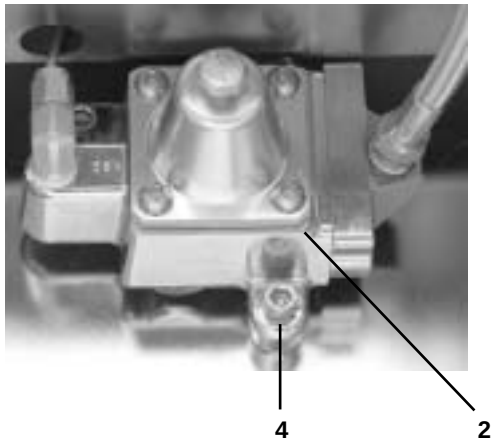
8.16 Pipeline inlet fittings



Item	Description		Stock Number
1	**Pipeline inlet - O_2 fittings**		----------
	Body, O_2 DISS		1006-5149-000
	Body, O_2 NIST		1006-5158-000
	Body, O_2 DIN		1006-5161-000
	Body, O_2 G 3/8 BSPP		1006-5170-000
	Pipeline inlet assembly O_2 France		1006-8363-000
	Pipeline inlet assembly O_2 Canada		1006-8360-000
	Pipeline inlet assembly O_2 Australia		1006-8396-000
1	**Pipeline inlet - N2O fittings**		----------
	Body, N_2O DISS		1006-5150-000
	Body, N_2O NIST		1006-5159-000
	Body, N_2O DIN		1006-5162-000
	Body, N_2O G 3/8 BSPP		1006-5171-000
	Pipeline inlet assembly N_2O France		1006-8362-000
	Pipeline inlet assembly N_2O Canada		1006-8359-000
	Pipeline inlet assembly N_2O Australia		1006-8397-000
1	**Pipeline inlet Air fitting**		----------
	Body, Air DISS		1006-5151-000
	Body, Air NIST		1006-5160-000
	Body, Air DIN		1006-5163-000
	Body, Air G 3/8 BSPP		1006-5172-000
	Pipeline inlet assembly Air France (service kit)		1006-8361-000
	Pipeline inlet assembly Air Canada (service kit)		1006-8358-000
	Pipeline inlet assembly Air Australia (service kit)		1006-8398-000
2	O-ring, bore seal		----------
	O_2 and N_2O		0210-0479-300
	Air		0210-0539-300
3	Sintered metal filter with o-ring		1006-8351-000
4	Pipeline checkvalve with o-ring		1006-3160-000
5	Gas Inlet Manifold (replacement)	O_2	1009-8066-000
		N_2O	1009-8067-000
		Air	1009-8068-000
6	Relief valve, 758 kPa (110 psi)		1011-3049-000
7	Screw, M4x20		0144-2124-218
	Lockwasher, M4 external		9213-0540-003

8.17 Cylinder Gas Supplies



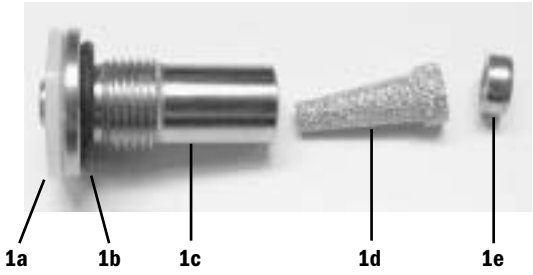


Item	Description	Pin Index (Inboard)	DIN (Inboard)	DIN, Large Cylinder (Inboard)
1	Gas supply O_2	1006-3201-000	1006-3207-000	1006-3880-000
1	Gas supply N_2O	1006-3202-000	1006-3208-000	1006-3881-000
1	Gas supply Air	1006-3203-000	1006-3209-000	- - - - -
		Pin Index (Outboard)		
2	Gas supply N_2O	1009-8210-000		

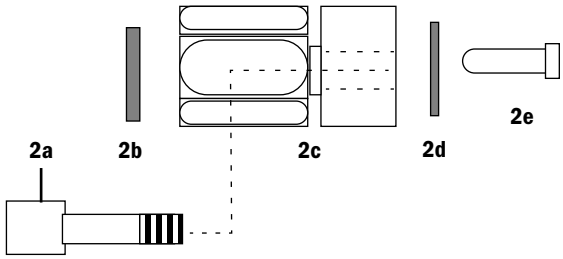
Item	Description	Stock Number
3	Standoff (3 per supply)	1009-3085-000
	Screw, M6x80 socket head cap (3 per supply)	0144-2131-913
	Lockwasher, M6 external (for above screw)	9213-0560-003
4	Screw, M6x25 socket head cap (3 per supply)	9211-0660-254
	Lockwasher, M6 external (for above screw)	9213-0560-003
5	Cylinder inlets (Pin Index or DIN for external cylinder)	Refer to section 8.17.1
6	Tee handle beige	0219-3372-600
7	Clamp, yoke	1001-4076-000
8	Spacer, gas block (2)	1001-4077-000
	Screw, M8 x 25 long socket head cap (2)	9211-0680-253
9	Elbow fitting for cylinder pressure gauge (copper tube connection of gas supply)	1006-3713-000
10	Label Set, cylinder supply, O_2	1006-3854-000
	Label Set, cylinder supply, N_2O	1006-3855-000
	Label Set, cylinder supply, Air	1006-3856-000

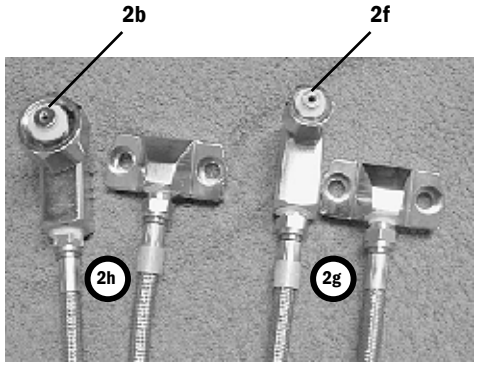
8.17.1 Cylinder inlet fittings

1 Pin Index



2 DIN (external cylinder)

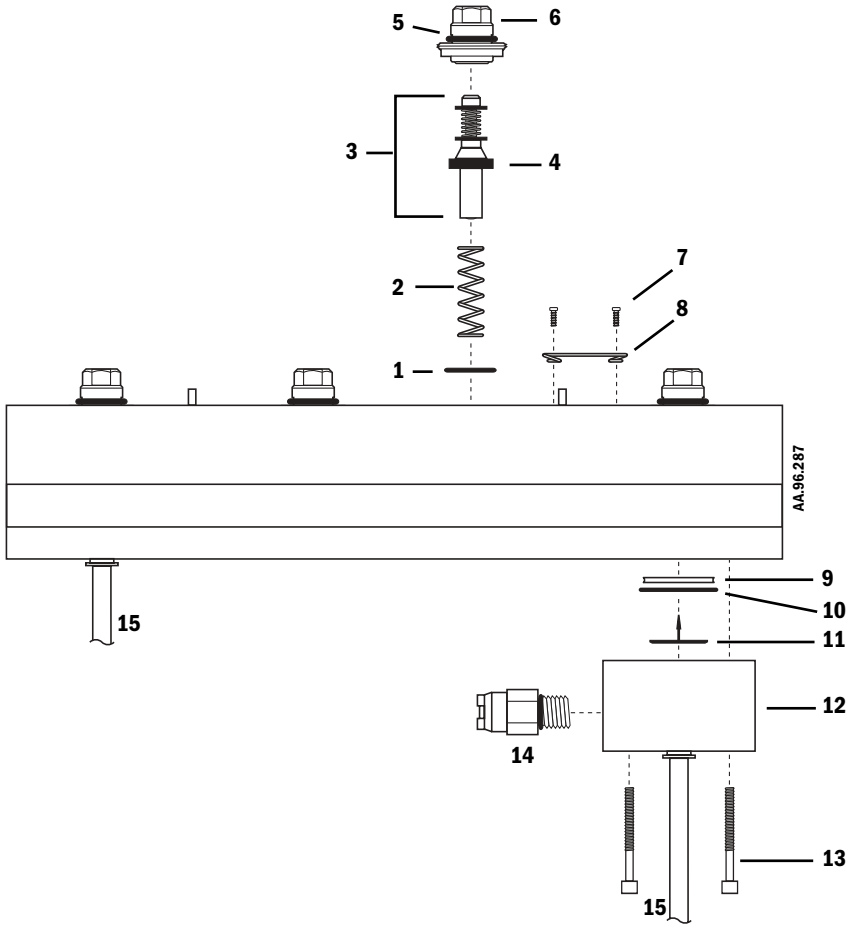




Item		Description	Stock Number
1		**Cylinder inlets (Pin Index)**	----------
	1a	Gasket	0210-5022-300
	1b*	O-ring	9221-3013-116
	1c	Adapter, inlet	1001-4075-000
	1d	Filter, sintered bronze	9914-6380-000
	1e	Retaining ring, filter	1001-5954-000
2		**Cylinder inlets (DIN)**	----------
	2a	Screw, M8x16	0144-2140-242
	2b	Sealing ring (DIN)	1009-3356-000
	2c	DIN Adapter (O_2)	1006-4000-000
		DIN Adapter (N_2O)	1006-4001-000
		DIN Adapter (Air)	1006-4002-000
	2d	O-ring, 0.687 ID, 0.812 OD	0210-0544-300
	2e	Filter, sintered bronze	9914-6380-000
	2f	Sealing ring, N_2O DIN Conn 11	1202-3641-000
	2g	Adapter, large cylinder N_2O	1006-4028-000
	2h	Adapter, large cylinder O_2	1006-4027-000

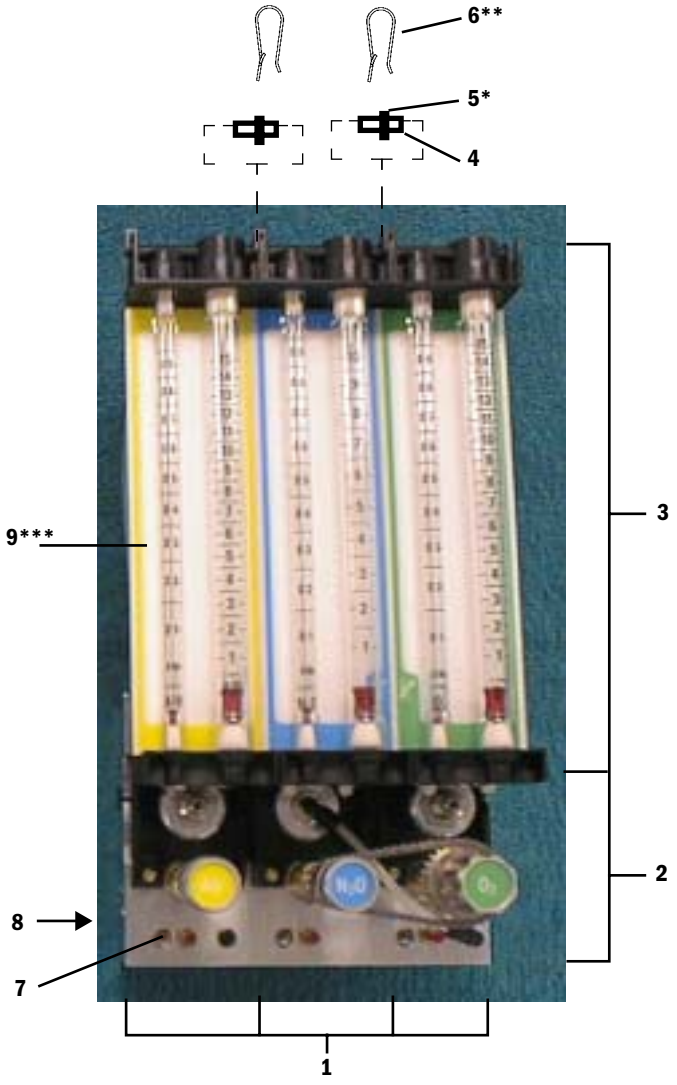
* Lubricate sparingly with Krytox

8.18 Vaporizer manifold

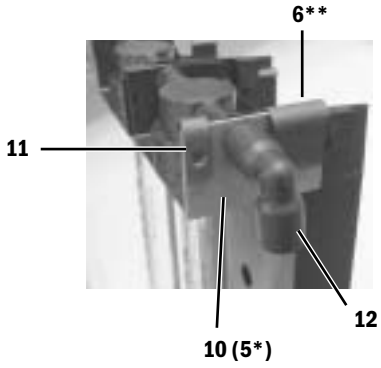


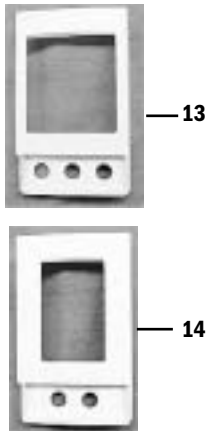
Item	Description	Stock Number
	Manifold assembly, complete, two position	1006-8355-000
	Manifold assembly, complete, one position	1009-8065-000
1	O-ring, 0.687 inch ID 0.812 inch OD	0210-0544-300
2	Spring, compression	1006-3736-000
3	Valve kit, includes seal	1006-8373-000
4	Seal	1006-3690-000
5	O-ring, 14.3 mm ID	1102-3043-000
	(Package of 6 o-rings)	1102-3016-000
6	Nipple, vaporizer port (New Style)	1006-4215-000
7	Screw, M2.5 - 0.45x6 PAN, Pozidriv, SST	1006-3037-000
8	Spring, Dzus	1102-3056-000
9	Seat, check valve	1006-1352-000
10	O-ring 27.1 OD 21.89 mm ID	1006-3866-000
11	Flapper	0211-1451-100
12	Housing	1006-1351-000
13	Screw, M4 x 30, cap head	9211-0640-304
14	Valve, relief, 5.5 psi, 7/16-20 THD	1006-4128-000
15	Flexible tubing, 1/4 inch, mixed gas	1001-3064-000

8.19 Flowmeter components



Single-tube Flowhead Outlet





Item	Description	Stock Number
1	**Flowhead Module:** includes regulator, flowtube module, flowtubes, needle valve, intermodule tube and associated o-ring, and label plate; does not include labels, link-25, or knobs (order separately).	----------
	O_2 flowhead module with dual flowtubes	1006-8380-000
	O_2 flowhead module with single flowtube	1009-8069-000
	N_2O flowhead module with dual flowtubes	1006-8381-000
	N_2O flowhead module with single flowtube	1009-8070-000
	Air flowhead module with dual flowtubes	1006-8383-000
	Air flowhead module with single flowtube	1006-8382-000
2	Secondary regulators/Balance Regulators	----------
	Regulator Kit, O_2 (adjustable), without pressure switch	1006-8341-000
	Regulator Kit, N_2O (pressure balancing)	1006-8344-000
	Regulator Kit, Air (adjustable)	1006-8340-000

Item	Description	Stock Number
3	**Flowtube Module:** includes housing, o-rings, and plug ball; does not include, flowtubes, label or label panel (order separately).	----------
	Flowtube module, O_2 - dual	1006-8338-000
	Flowtube module, O_2 - single	1009-8234-000
	Flowtube module, N_2O - dual	1006-8337-000
	Flowtube module, N_2O - single	1009-8235-000
	Flowtube module, Air - dual	1006-8333-000
	Flowtube module, Air - single	1006-8334-000
4	Tube, intermodule connector	1006-3628-000
5*	O-ring, intermodule connector	1006-3613-000
6**	Clip, U-type self retaining	1006-4350-000
7	Screw, M5x30 (module mounting)	1102-3049-000
8	Screw, M5x55 (O_2/N_2O/3rd gas module connect)	1006-3607-000
	Screw, M5x110 (O_2 - Air module connect)	1006-3080-000
	Washer, M5 (O_2 - Air module connect)	1006-1459-000
	Nut, M5 Keps (O_2 - Air module connect)	0144-3717-324
9***	Flowmeter labels	refer to chart below
	Label panel, flowmeter module	1006-1290-000
	Side panel, (O_2 - Air flowmeter module)	1009-3186-000
	Screw, label panel	1006-3608-000
10	Adapter, single-tube outlet	1009-3056-000
11	Clip, small	1009-3309-000
12	Elbow, 1/4 inch	1202-3804-000
13	Bezel, flowmeter 3-gas	1009-3104-000
14	Bezel, flowmeter 2-gas	1009-3108-000

* Lubricate sparingly with Krytox.

** Note orientation of item 6; with flowmeter facing forward, the barbs should face to the left.

*** Position the label on the panel so that the right edge of the label is flush with the right edge of the panel. The left edge of the label will extend slightly beyond the left edge of the panel. When mounted in the flowmeter module, the flowmeter label on the right should slightly overlap the flowmeter label directly to its left.

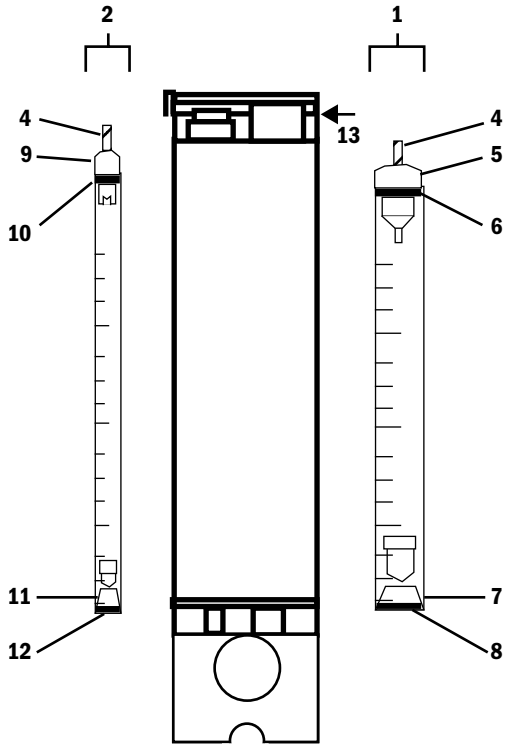
**** The O_2 label set contains a label for both the dual-tube **(A)** and single-tube (**B**) modules. Make sure to install the correct label.

Chart: Flowmeter Labels (include knob labels)

	Stock Number	Stock Number	Stock Number
ANSI	**Air (Yellow)**	**N_2O (Blue)**	**O_2 (Green)**
	1006-0209-000	1009-3209-000	1009-3210-000
ISO	**O_2 (Neutral)**	**N_2O (Blue)**	**Air (Black/White)**
	1009-3211-000	1009-3209-000	1009-3242-000
Neutral	**O_2 (Neutral)**	**N_2O (Neutral)**	**Air (Neutral)**
	1009-3211-000	1009-3240-000	1009-3240-000

8.19.1 Flowtube parts

Item	Description	Stock Number
1	**Large flowtube kits** (includes float, filter, o-rings, tube)	----------
	Flowtube kit, Air, large	1006-8325-000
	Flowtube kit, N_2O, large	1006-8329-000
	Flowtube kit, O_2, large	1006-8331-000
2	**Small flowtube kits** (includes float, filter, o-rings, tube)	----------
	Flowtube kit, Air, small	1006-8326-000
	Flowtube kit, N_2O, small	1006-8330-000
	Flowtube kit, O_2, small	1006-8332-000
3	**Single-tube flowtube kits** (includes float, filter, o-rings, tube)	----------
	Flowtube kit, single-tube Air flowmeters use the Large flowtube kits	
	Flowtube kit, N_2O, single-tube, dual-taper with filter	1009-8199-000
	Flowtube kit, O_2, single-tube, dual-taper with filter	1009-8198-000
4	Spring, top of flowtubes	1006-3624-000
5	Float stop, O_2 large	1006-1225-000
	Float stop, N_2O large	1006-1226-000
	Float stop, Air large	1006-1227-000
6	O-ring, 17.6 OD, 12.37 ID, large flowtube, top	1006-3615-000
7	Filter, large flowtube	1006-3584-000
8	O-ring, 17.6 OD, 12.37 ID, large flowtube, bottom (red)	1006-3968-000
9	Float stop, O_2 small	1006-1233-000
	Float stop, N_2O small	1006-1234-000
	Float stop, Air small	1006-1235-000
10	O-ring, 11.26 OD, 6.02 ID, small flowtube, top	1006-3617-000
11	Filter, small flowtube	1006-3583-000
12	O-ring, 11.26 OD, 6.02 ID, small flowtube, bottom (red)	1006-3969-000
13	Ball, 6 mm (plug fresh gas end)	1006-1353-000
Not Shown:		
	O-ring Kit, flowtubes (includes 4 each of top and bottom o-rings for large flowtube and 3 each of top and bottom o-rings for small flowtube).	1006-8393-000
	Silicon tube kit, long, including cable ties	1006-8378-000
	Silicon tube kit, short, including cable ties	1006-8379-000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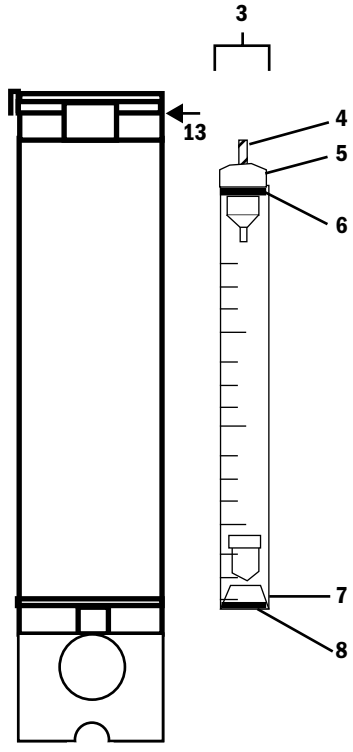
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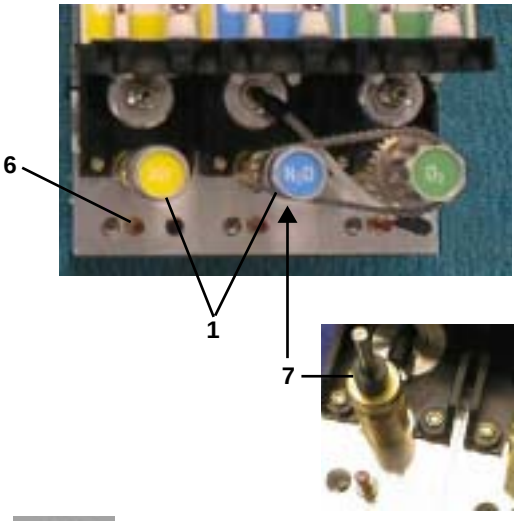
8.19.2 Secondary regulator components

Item	Description	Stock Number
1	Knob (N_2O) (Air) without label	1006-3633-000
2	O_2 Proportioning assembly (includes knob, sprocket, set screws, without knob label)	1006-8339-000
3	Set screw	0141-4227-105
4	O_2 Proportioner chain	1006-3610-000
5	Sprocket, N_2O	1006-3625-000
6	Plug, 1/8 inch	1006-3611-000
7	Spacer, link system, N_2O needle valve	1006-5140-000
8	Valve, needle (O_2) (Air)	1006-8346-000
	Valve, needle N_2O (has notch around valve body)	1006-8345-000
9	O-ring, 10.1 ID 13.3 OD	9221-3010-116
10	O-ring, 0.250 inch ID 0.375 inch OD	0210-0687-300
11	Stop collar (all gases)	1006-3632-000
12	Maximum stop collar kit (includes item 13) *Maximum stop collars are required in Canada for all gas flow controls.*	1006-8055-000
13	Mounting screw, M3x8, SKT HD CAP	1006-3865-000
14	Pressure switch, O_2 supply alarm	1006-3623-000
15	O-ring, 0.250 inch ID 0.375 inch OD	0210-0687-300
16	Screws, M4x12 Pozidriv PAN	0140-6226-111
17	Plug, pressure switch cavity	1006-3665-000
18	Screws, M4x8 Pozidriv PAN	1006-3178-000
19	Fitting, O_2 pilot, plug-in elbow	1006-3533-000
20	Fitting, O_2 pilot, thread-in elbow	1006-3663-000
21	Tubing, 4-mm (RH head 144 mm - LH head 164 mm)	1001-3060-000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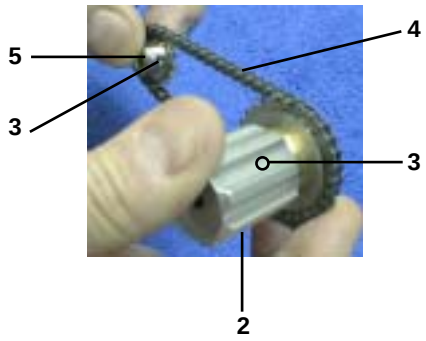
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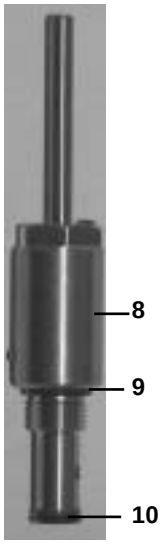
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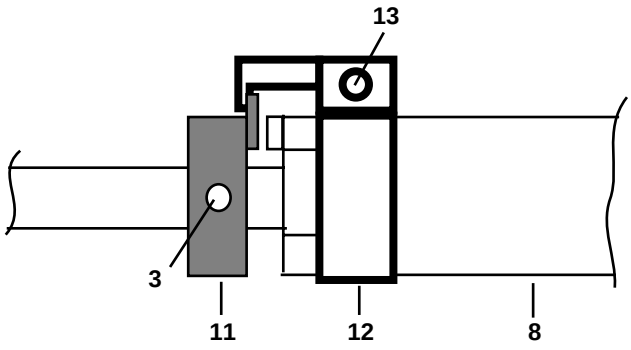
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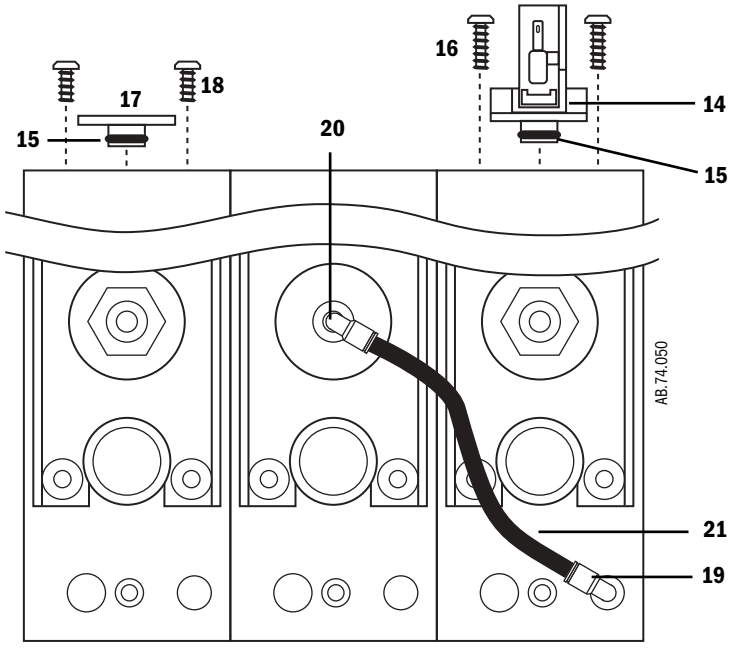
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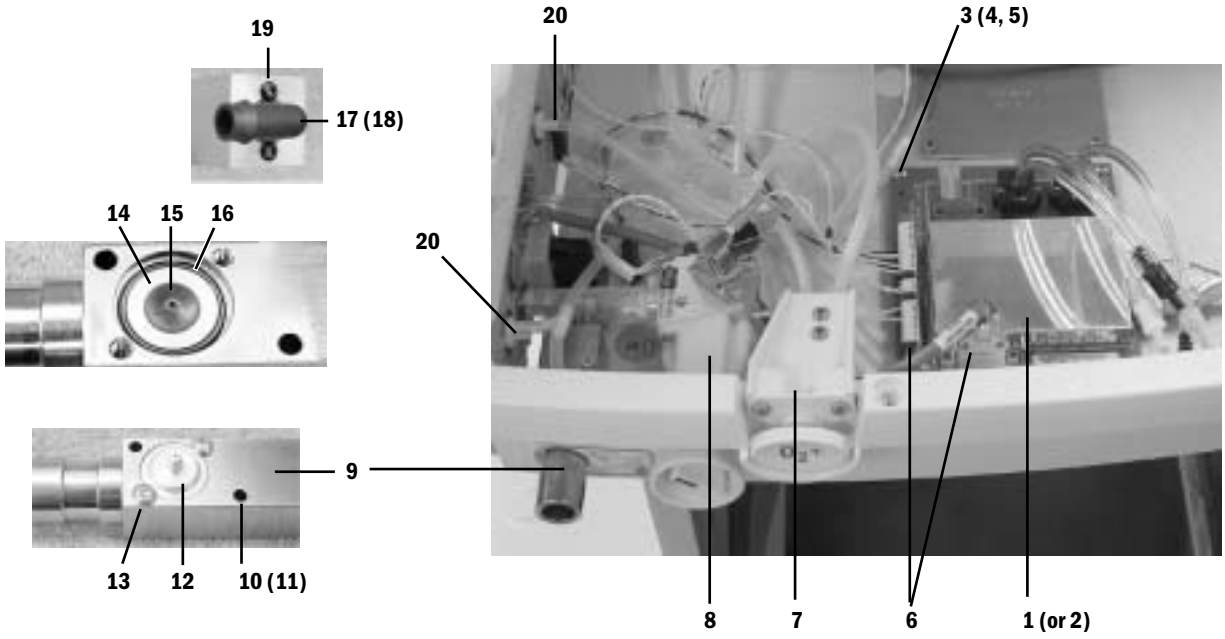
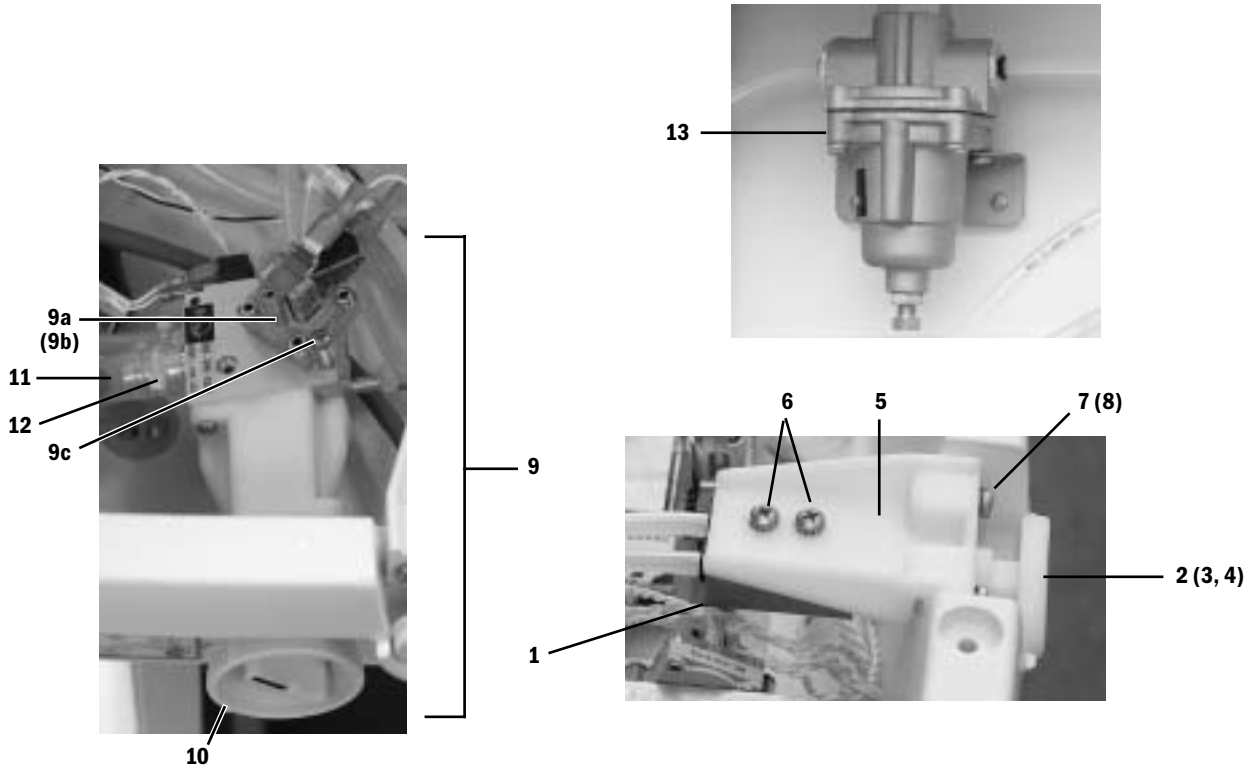
8.20 ABS to machine Interface Components



Item	Description	Stock Number
1	PCA VENT MONITORING BRD [TESTED VMB]	1009-8002-000
2	PCA B/S task light interface board (used when no monitoring is ordered)	1009-5681-000
3	SCR M4X12 POZI-DR PAN SST TYPE 316	0140-6226-111
4	WASH/LOCK EXT M4 DIN 6797 SST TYPE 316	9213-0540-003
5	SPACER.171 IN ID 0.250IN OD 0.250 IN LG ALUMINUM	1202-3693-000
6	Cables and harnesses	Refer to section 8.27
7	O_2 Flush Valve	Refer to section 8.20.1
8	ACGO Selector Valve	Refer to section 8.20.1
9	Port, ACGO body	1009-3096-000
10	Screw, M4x30	9211-0640-304
11	Lockwasher, M4	9213-0540-003
12	Cap, ACGO check valve	1009-3095-000
13	Screw, M4x8	9211-1040-069
14	Disk, ACGO check valve	1009-3062-000
15	Flapper, ACGO check valve	1009-3097-000
16*	O-ring	0210-0543-300
17	Fitting, elbow barbed	1009-3160-000
18*	O-ring	0210-0691-300
19	Screw, M3x6	9211-1030-055
20	Tie wrap	0203-5915-300

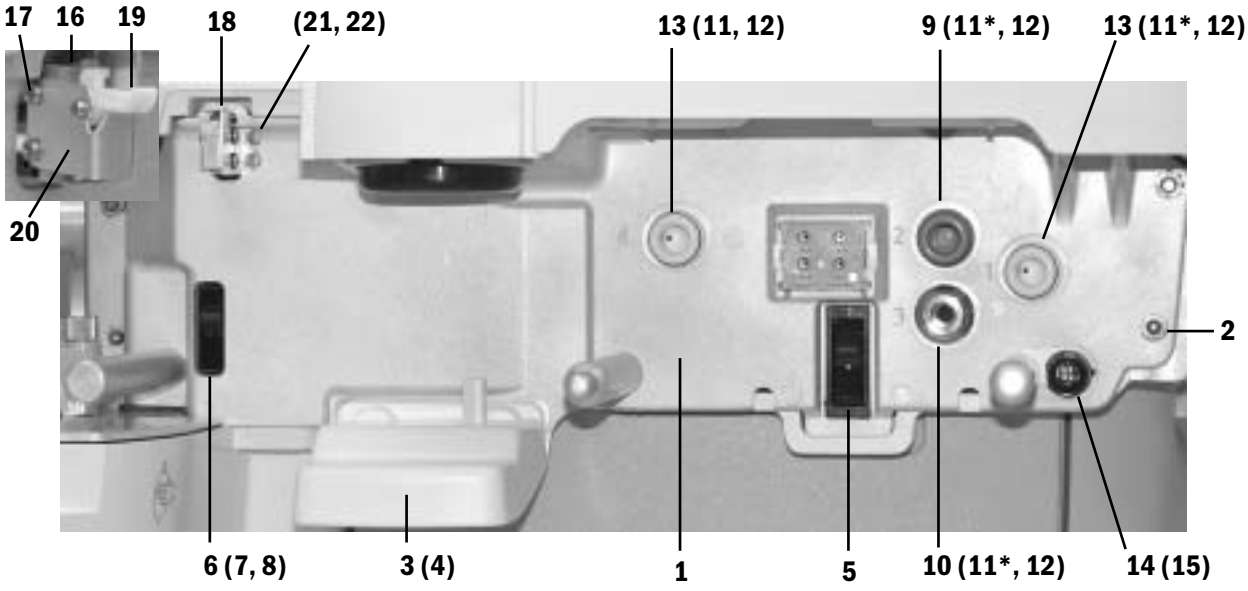
* Lubricate sparingly with Krytox.

8.20.1 Flush Regulator, Flush Valve, and ACGO Selector Switch



Item		Description	Stock Number
1		Flush valve, without button	1006-8357-000
2		Flush Button with rod	1011-3354-000
3		Spring	1006-3186-000
4		E-clip	0203-5225-300
5		Bracket	1011-3355-000
6		Screw, M4x8	1006-3178-000
7		Screw, M4x12	0140-6226-111
8		Lockwasher, M4	9213-0540-003
9		ACGO Selector Switch, complete (without guard - item 10)	1009-3099-000
	9a	Flush pressure switch	1006-3972-000
	9b	O-ring	1006-3213-000
	9c	Screws	0144-2124-201
10		Guard	1009-3140-000
11		Tubing, silicone	1009-3164-000
12		Tie wrap	0203-5915-300
13		Regulator, O_2 Flush	1011-3168-000

8.21 Breathing system interface

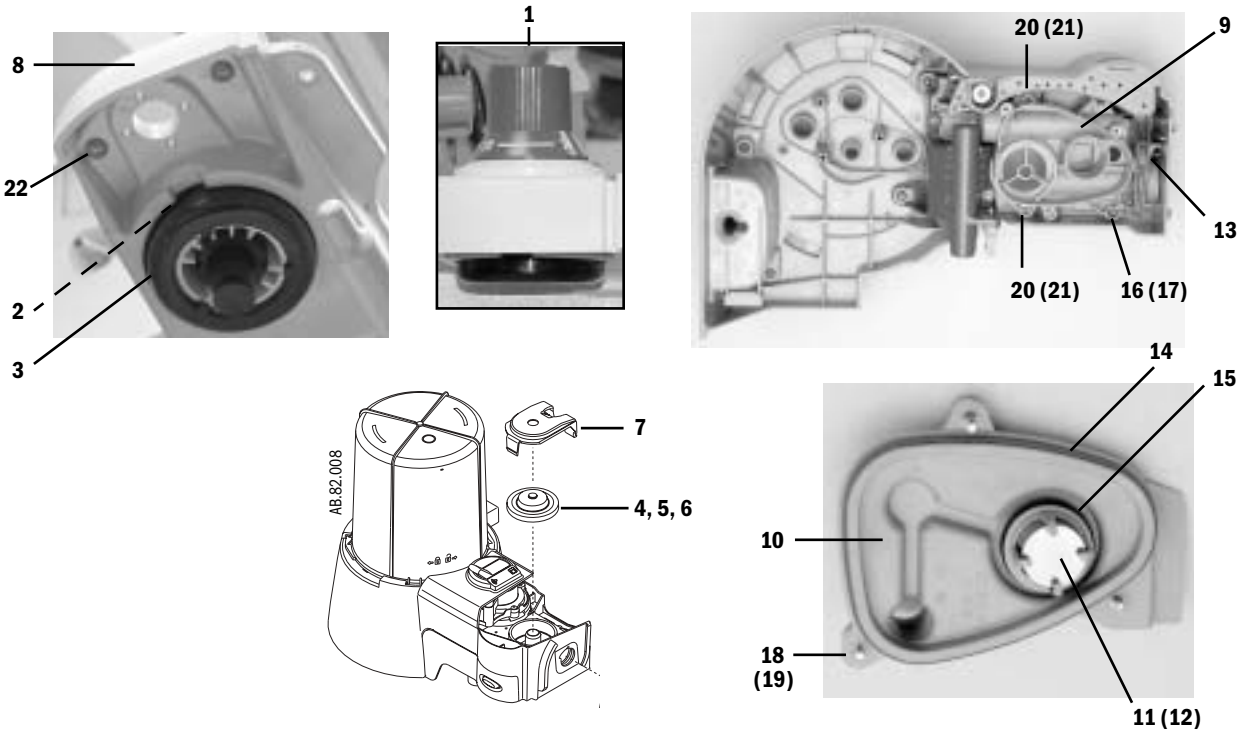


Item	Description	Stock Number	Qty
1	ASSEMBLY MAIN SUPPORT CASTING	1407-7010-000	
2	Bolt, M6x16 flange	1009-3125-000	(5)
3	HANDLE GRIP	1407-3317-000	
4	SCR M6X16 Sems	0144-2436-109	(2)
5	LATCH PUSH TO CLOSE	1407-3309-000	
6	LATCH PUSH TO CLOSE W/MICROSWITCH	1407-3310-000	
7	SCR SKT HD CAP M3-0.5X8 SST	1006-3865-000	(2)
8	WASHER LOCK EXTERNAL M3	9213-0530-003	(2)
9	Port, plug circuit	1407-3333-000	
10	Port, fresh gas	1407-3314-000	
11*	SEAL U-CUP 12.7 ID BCG 19.05 OD EPR	1407-3320-000	(4)
12	RING RET 15.88 SHAFT DIA TYPE E SST	1406-3446-000	(4)
13	Port, sample gas	1407-3318-000	(2)
14	Connector, BULKHEAD O2 CELL, with harness	1009-5586-000	
15	RING RETAINING 9.53 SFT DIAMETER TYPE E SST	1406-3277-000	
16	SW SUBMINITURE W/QDISC TERMINALS	1406-3296-000	
17	SCR M2.5 X 10	1009-3153-000	(2)
18	BRACKET BTV SWITCH	1407-3319-000	
19	LEVER BTV SWITCH	1407-3325-000	
20	CAP BRACKET BTV	1407-3324-000	
21	SCR SKT HD CAP M3-0.5X8 SST	1006-3865-000	(2)
22	WASHER LOCK EXTERNAL M3	9213-0530-003	(2)

* Lubricate sparingly with Krytox.

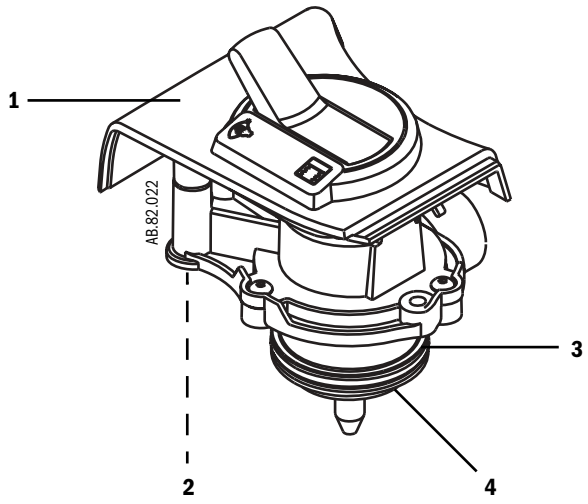
8.22 Breathing System

8.22.1 APL Valve



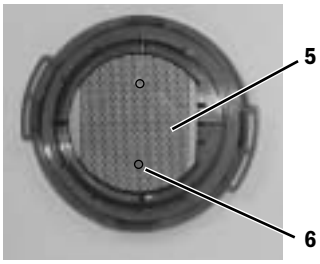
Item	Description	Stock Number	QTY
1	APL Valve Assy (includes items 2 through 6)	1009-8200-000	
2	SPRING CPRSN 53.14 OD 36.8 L 1.48 N/MM	1406-3328-000	
3	RETAINER SPRING APL	1407-3404-000	
4	DIAPHRAGM APL	1406-3331-000	
5	CAGE APL	1406-3333-000	
6	POPPET APL VALVE	1406-3332-000	
7	RAMP APL	1407-3400-000	
8	COVER APL	1407-3405-000	
9	MANIFOLD APL/BTV	1407-3401-000	
10	Cover, Manifold APL/BTV (with 22-mm male bag port)	1407-3402-000	
	Cover, Manifold APL/BTV (with Australian bag port - 22 mm female)	1407-3412-000	
10	COVER MANIFOLD APL/BTV	1407-3402-000	
11	WEIGHT DEAD 14CM H2O BCG ABS NEG RELIEF	1407-3406-000	
12	SEAL ABS NEG RELIEF VLV	1407-3407-000	
13	O-RING 22 ID 30 OD 4 W SI 40 DURO	1407-3104-000	
14	O-RING 88.49 ID 95.55 OD 3.53 W SILICONE 50 DURO	1407-3403-000	
15	O-RING 1.049ID 1.255OD 0.103W EPDM NO 121	1407-3408-000	
16	SCR M4X16 BT SKT HD SST TYPE 316	0140-6226-115	(2)
17	Lockwasher, M4 external	9213-0540-003	(2)
18	SCR THUMB M4 SHLDR 7.5 X 7	1407-3410-000	(3)
19	RING RETAINING 3.96 SFT DIA CRESCENT SST	1407-3411-000	(3)
20	SCR M4 X 40 FL HD SST PH	0140-6226-122	(2)
21	O-RING 2.9 ID 6.46 OD 1.78 W EP 70 DURO	1407-3409-000	(2)
22	SCR SEMS M4X8 BT SKT HD W/EXT L/W SST 316	0144-2436-108	(3)

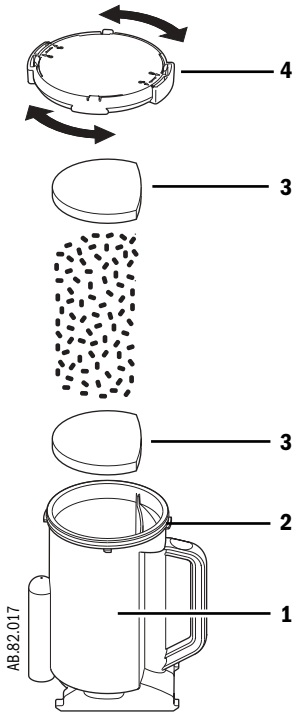
8.22.2 Bag/Vent Switch



Item	Description	Stock Number	QTY
	BTV Switch Cartridge	1407-7003-000	
1	COVER BTV	1407-3500-000	
2	SCR SEMS M4X8 BT SKT HD W/EXT L/W SST 316	0144-2436-108	(2)
3	O-RING 44.02 ID 51.1 OD 3.53 W SI 70 DURO	1407-3507-000	
4	SEAL, BTV	1407-3506-000	

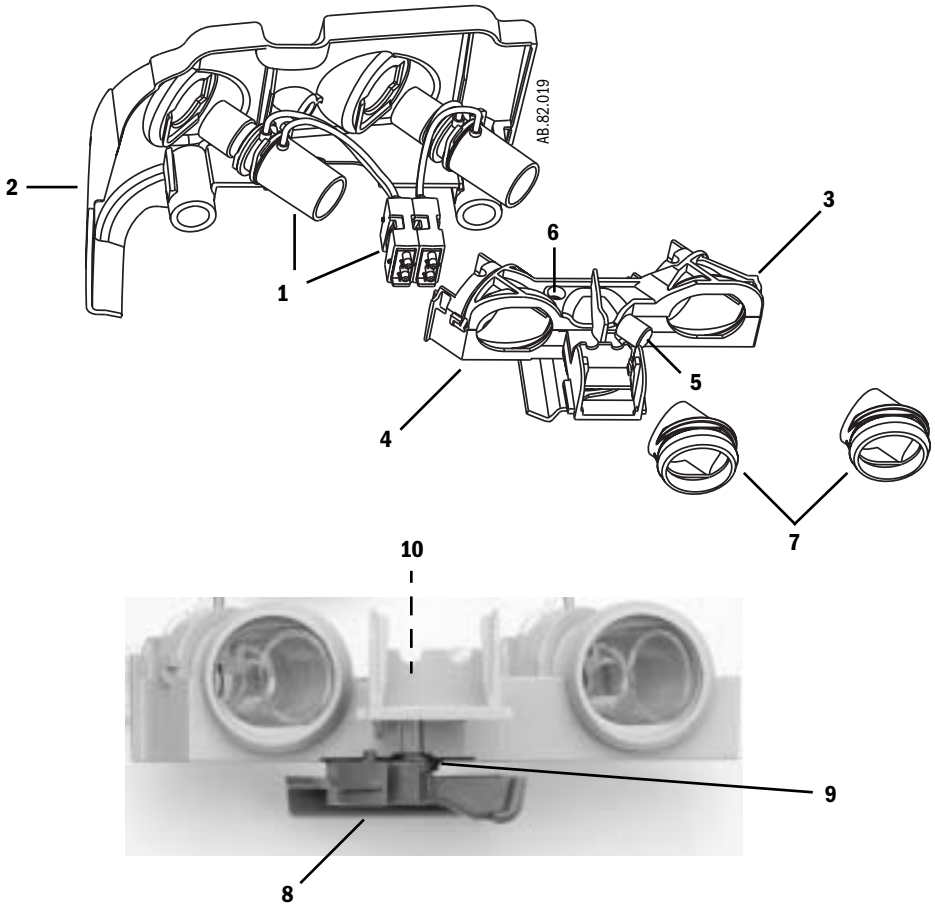
8.22.3 Absorber canister





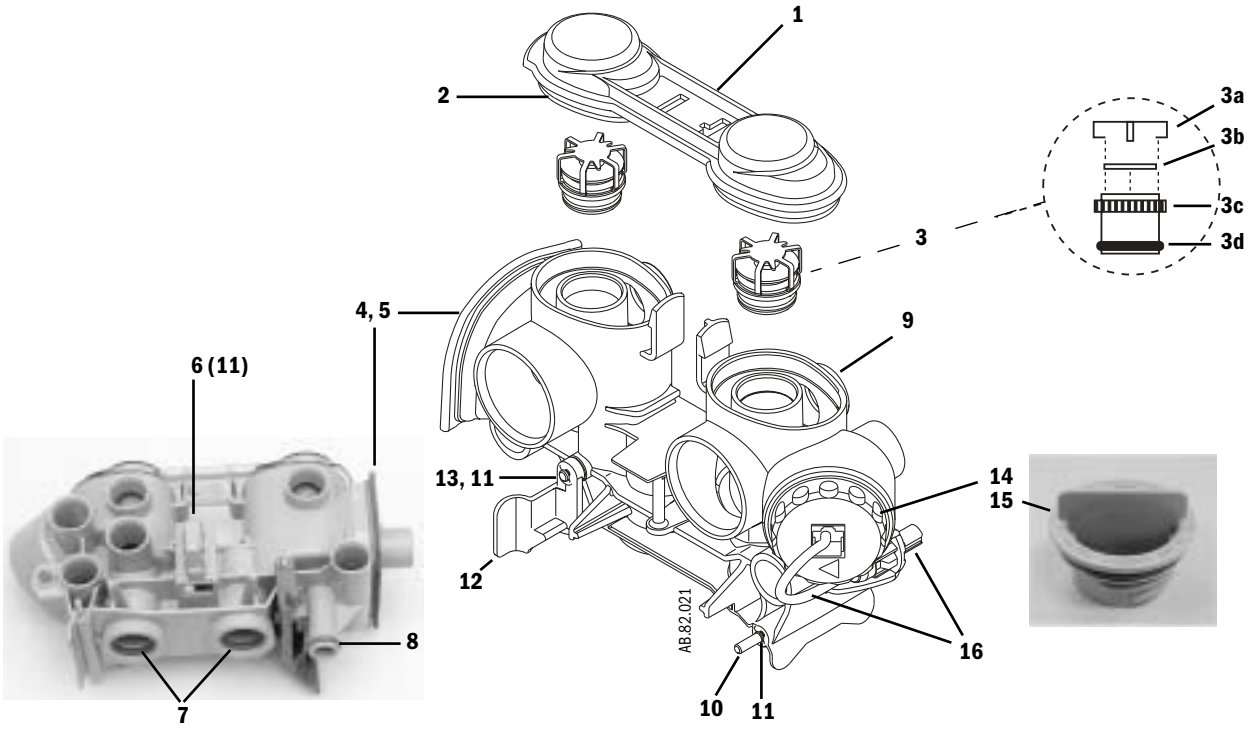
Item	Description	Stock Number	Qty
	Absorber Canister, Reusable	1407-7004-000	
1	CANISTER, CO2	1407-3200-000	
2	O-RING 110.72 ID 117.78 OD 3.53 W EPR 50 DURO	1407-3204-000	
3	FOAM, CO2 CANISTER (PKG 40)	1407-3201-000	
4	COVER, CO2 CANISTER with LOCKING RING (does not include items 5 and 6)	1407-3203-000	
5	SCREEN, CO2 CANISTER COVER	1407-3205-000	
6	SCREW, M3X8 FL PH HD SST	9211-0530-083	(2)

8.22.4 Flow Sensor Module



Item	Description	Stock Number	Qty
	Flow Sensor Module (does not include Item 1)	1407-7001-000	
1	Flow Sensor (plastic) Flow Sensor (metal - autoclavable) Flow Port Adapter	1503-3856-000 1503-3244-000 1503-3849-000	
2	COVER FLOW SNSR	1407-3000-000	
3	HOLDER FLOW SNSR UPPER	1407-3002-000	
4	HOLDER FLOW SNSR LOWER	1407-3003-000	
5	SCR THUMB M6X43 SST	1406-3304-000	
6	SCR M4 X 10 SKT CAP BUTTON HEAD SST	0144-2117-718	(2)
7	CUFF FLOW SNSR	1407-3004-000	(2)
8	LATCH FLOW SNSR	1407-3001-000	
9	SPR TORSION FLOW SNSR LATCH	1407-3005-000	
10	RING TRUARC 0.188 SHAFT E-RING SST	0203-5225-300	

8.22.5 Breathing Circuit Module

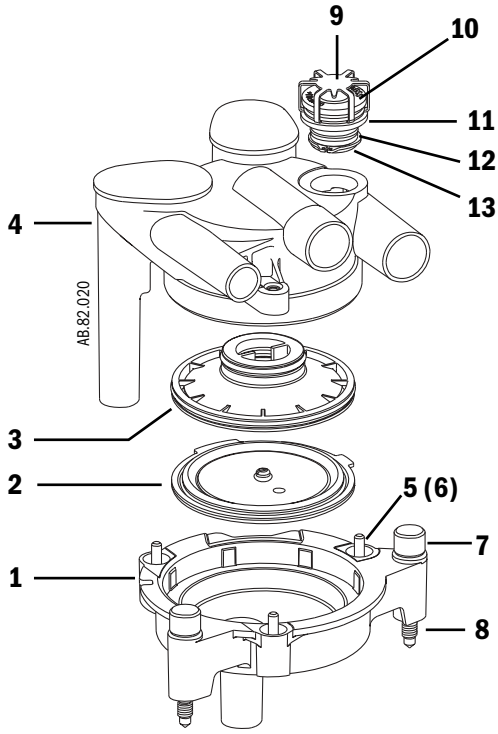


Item	Description	Stock Number	Qty
	Breathing Circuit Module (*)	1407-7002-000	
1	LENS CIRCUIT CHK VALVES	1407-3101-000	
2	O-RING 44.02 ID 51.1 OD 3.53 W SI 70 DURO	1407-3507-000	(2)
3	Check Valve Assembly	1406-8219-000	(2)
3a	RETAINER DISK 26.97D 12.7H 0.76T	1400-3017-000	(2)
3b	DISC CHK V RVSBL 1.025D	0210-5297-100	(2)
3c	SEAT UNIDIRECTIONAL V B/S	1406-3396-000	(2)
3d	O-RING 20.35 ID 23.90 OD 1.78W	1406-3397-000	(2)
4	PLATE CIRCUIT FLANGE	1407-3110-000	
5	SCR SEMS M4X8 BT SKT HD W/EXT L/W SST 316	0144-2436-108	(6)
6	HOOK LATCH	1407-3604-000	
7**	O-RING, 22 ID 30 OD 4 W SI 40 DURO	1407-3104-000	(2)
8**	O-RING, 12.37 ID 17.6 OD	1006-3968-000	
9	MANIFOLD CIRCUIT	1407-3100-000	
10	PIN CANISTER PIVOT	1407-3109-000	
11	RING TRUARC 0.188 SHAFT NO 5133-18H E-RING SST	0203-5225-300	(5)
12	LEVER CANISTER LATCH	1407-3102-000	
13	PIN CANISTER LEVER	1407-3108-000	
14*	O_2 Cell	6050-0004-110	
	O-ring, cell	1406-3466-000	
15*	Plug with o-ring (for units without circuit O_2 sensing)	1503-3857-000	
	O-ring, plug	1407-3112-000	
16*	Cable, O_2 Cell	1009-5570-000	

* The O_2 cell (or plug) and the cell cable are not included in the breathing circuit module.

** Lubricate sparingly with Krytox.

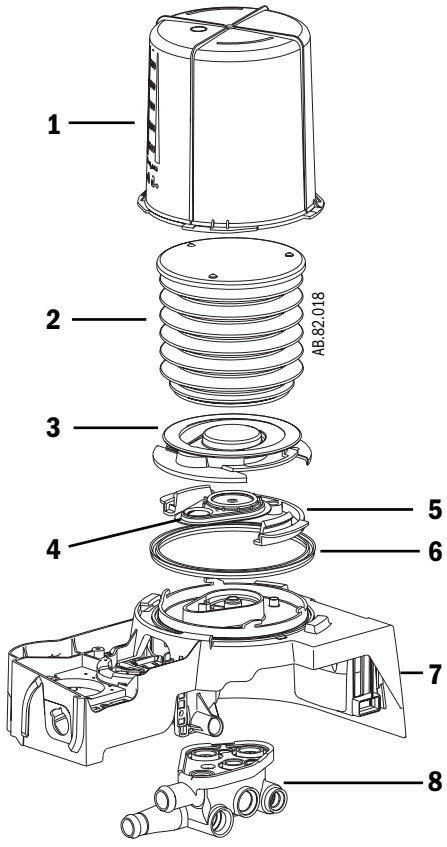
8.22.6 Exhalation valve



Item	Description	Stock Number	Qty
	Exhalation Valve Assy	1407-7005-000	
1	BASE EXHALATION VALVE	1407-3700-000	
2	DIAPHRAGM ASSY EXH VALVE	1503-8121-000	
3	SEAT EXHALATION VLV ABS	1407-3704-000	
4	COVER EXHALATION VALVE	1407-3701-000	
5	SCR M4X16 PH PAN HD SST TYPE 316	9211-0440-163	(3)
6	O-RING 2.9 ID 6.46 OD 1.78 W EP 70 DURO	1407-3409-000	(3)
7	SCR THUMB M6X43 10MM HEAD B/S	1406-3306-000	(2)
8	O-RING 4.47 ID X 8.03 OD 1.78 W EPR 70 DURO	1407-3703-000	(2)
9	RETAINER DISK 26.97D 12.7H 0.76T SST FLUTTER V	1400-3017-000	
10	WEIGHT DEAD 10 CMH2O BCG PASSIVE AGSS	1406-3572-000	
11	SEAT POSITIVE PRESS BCG VALVE PASSIVE AGSS	1406-3571-000	
12*	O-RING OD19.16 BCG ID15.6 EPDM DURO 70 -016	1006-3616-000	
13	RING RETAINING 19.05 SHAFT DIA SST	1406-3577-000	

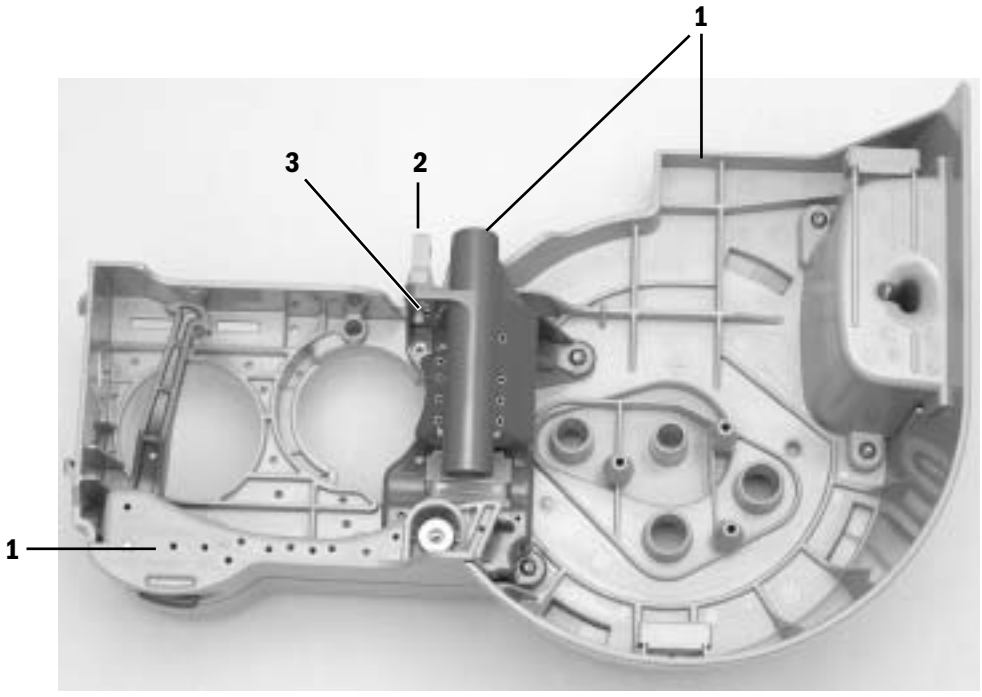
* Lubricate sparingly with Krytox.

8.22.7 Bellows



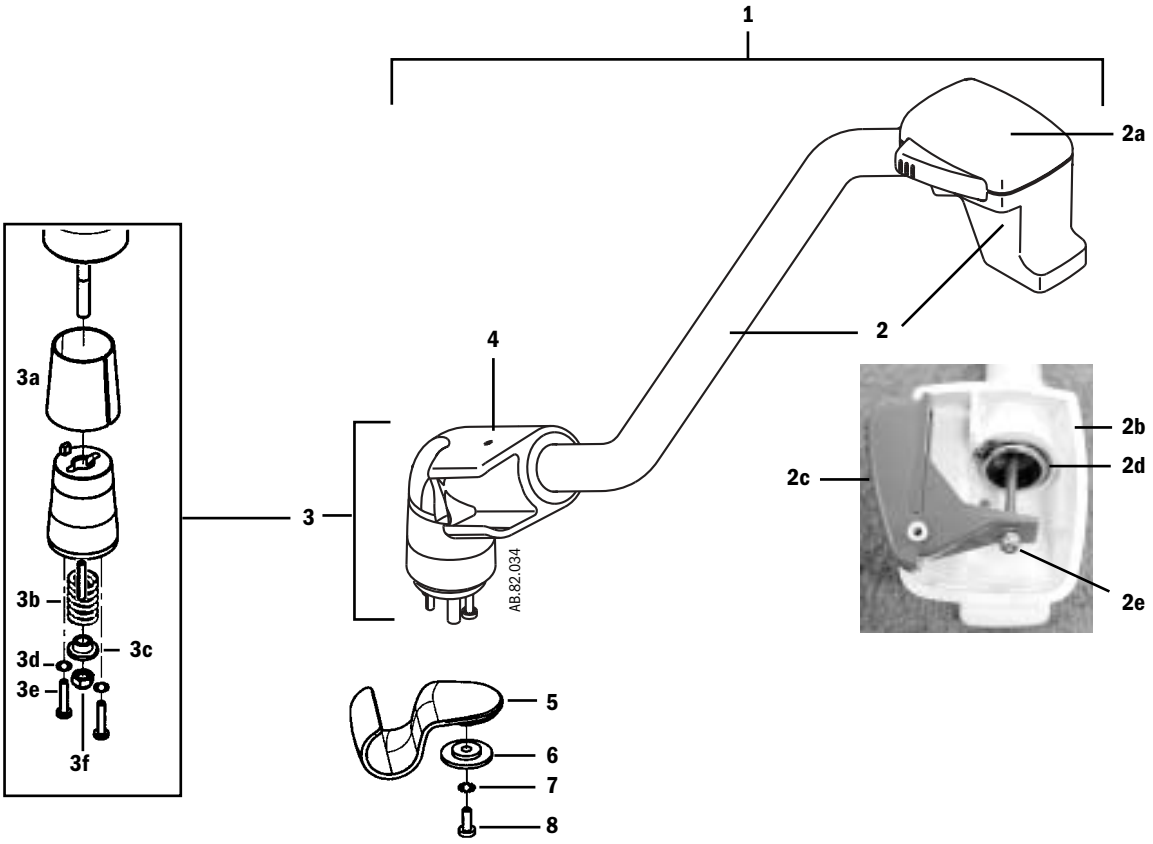
Item	Description	Stock Number
1	Bellows housing	1500-3117-000
2	Bellows	1500-3378-000
3	Rim	1500-3351-000
4	Pressure relief valve assy	1500-3377-000
5	Latch, base	1500-3352-000
6	Seal, base	1500-3359-000
7	Base, bellows	Refer to section 8.22.8
8	Manifold, bellows base	1407-3702-000

8.22.8 Bellow base



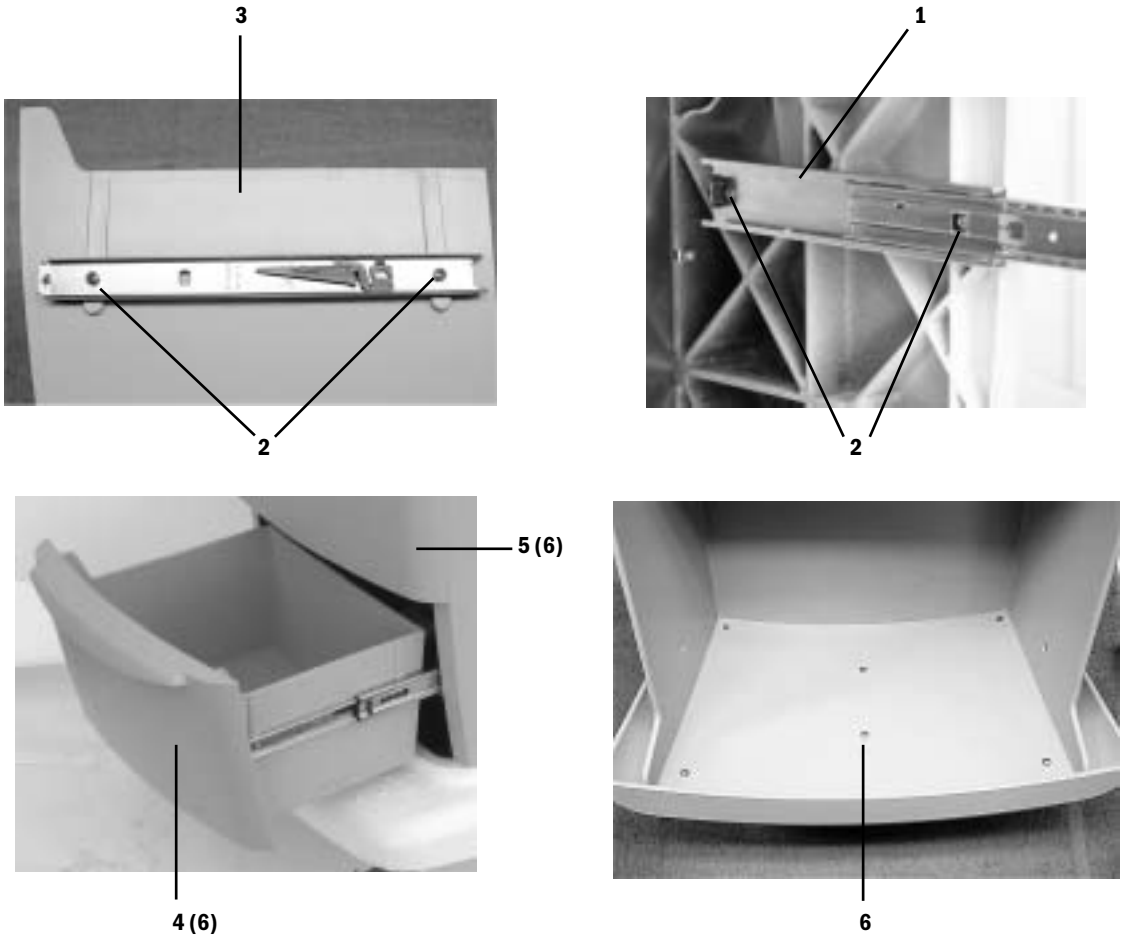
Item		Description	Stock Number
1		Bellows Base Assy	1407-7006-000
	1a	Latch Assy	1407-7007-000
2		HOOK LATCH	1407-3604-000
3		E-Ring	0203-5225-300

8.22.9 Bag Arms



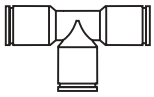
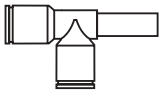
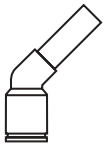
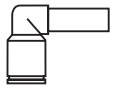
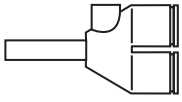
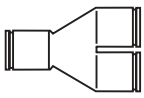
Item		Description	Stock Number	Qty
1		Bag Arm Assembly (complete)	1009-8159-000	
2		Bag Arm Upper Assembly	1407-7011-000	
	2a	Cover, bag port housing	1407-3807-000	
		Screw, M3x20	0140-6719-103	
		Lockwasher, M3 internal	9213-0430-003	
	2b	Housing, bag port	1407-3806-000	
	2c	Lever, lock release	1407-3808-000	
	2d	Ring, retaining	1406-3577-000	
	2e	Nut, M3 Nyloc	0144-3536-112	
3		Bag Arm Lower Assembly	1407-7012-000	
	3a	PAD FRICTION MATERIAL	1407-3818-000	
	3b	SPRING CPRSN	1406-3270-000	
	3c	WASHER, shoulder	1407-3815-000	
	3d	WASHER LOCK M3 INT SST	9213-0430-003	(2)
	3e	SCREW M3X16 POSI DR PAN HD A4 SST	1504-3003-000	(2)
	3f	Nut, M5 Nyloc	9212-0350-006	
4		Pin, dowel 3.18 DIA 31.8 L SST	1407-3804-000	
Items if no Bag Arm				
5		Clip, patient tubing	1407-3810-000	
6		Washer, shoulder	1407-3814-000	
7		Lockwasher, M4 external	9213-0540-003	
8		Screw, M4x16	9211-0440-163	

8.23 Drawer



Item	Description	Stock Number
1	Slide, drawer	1009-3084-000
2	Screw, M4x8 Nyloc	1009-3183-000
3	Drawer, body	1009-3078-000
4	Drawer Front, lower (down arrow)	1009-3032-000
5	Drawer Front, upper (up arrow)	1009-3031-000
6	Screw, M4x12	1009-3109-000

8.24 Legris quick-release fittings

Item	Description	Stock Number
	1 **Tees — (tube/tube/tube)**	
	4 mm (N_2O)	1202-3653-000
	6 mm (O_2)	1006-3544-000
	8 mm (Air)	1006-3545-000
	8 mm/6 mm/8 mm (SCGO pilot)	1009-3297-000
	2 **Tees — (tube/tube/standpipe)**	
	6 mm (O_2)	1006-3862-000
	8 mm (Air - Drive gas)	1009-3370-000
 	3 **Elbow — (tube/standpipe)**	
	4 mm (N_2O)	1006-3533-000
	6 mm (O_2)	1006-3534-000
	8 mm (Air)	1006-3535-000
	1/4 inch (mixed gas)	1006-3737-000
	1/4 inch (45° - mixed gas)	1009-3368-000
	4 **Elbow — (tube/tube)**	
	1/4 inch (mixed gas)	1202-3804-000
 	5 **Y**	
	6 mm (O_2)	1009-3043-000
	8 mm (Air)	1009-3044-000
	8 mm Y with tailpiece	1009-3360-000
	6 **Plug**	
	4 mm (N_2O)	1006-3530-000
	6 mm (O_2)	1006-3531-000
	8 mm (Air)	1006-3532-000

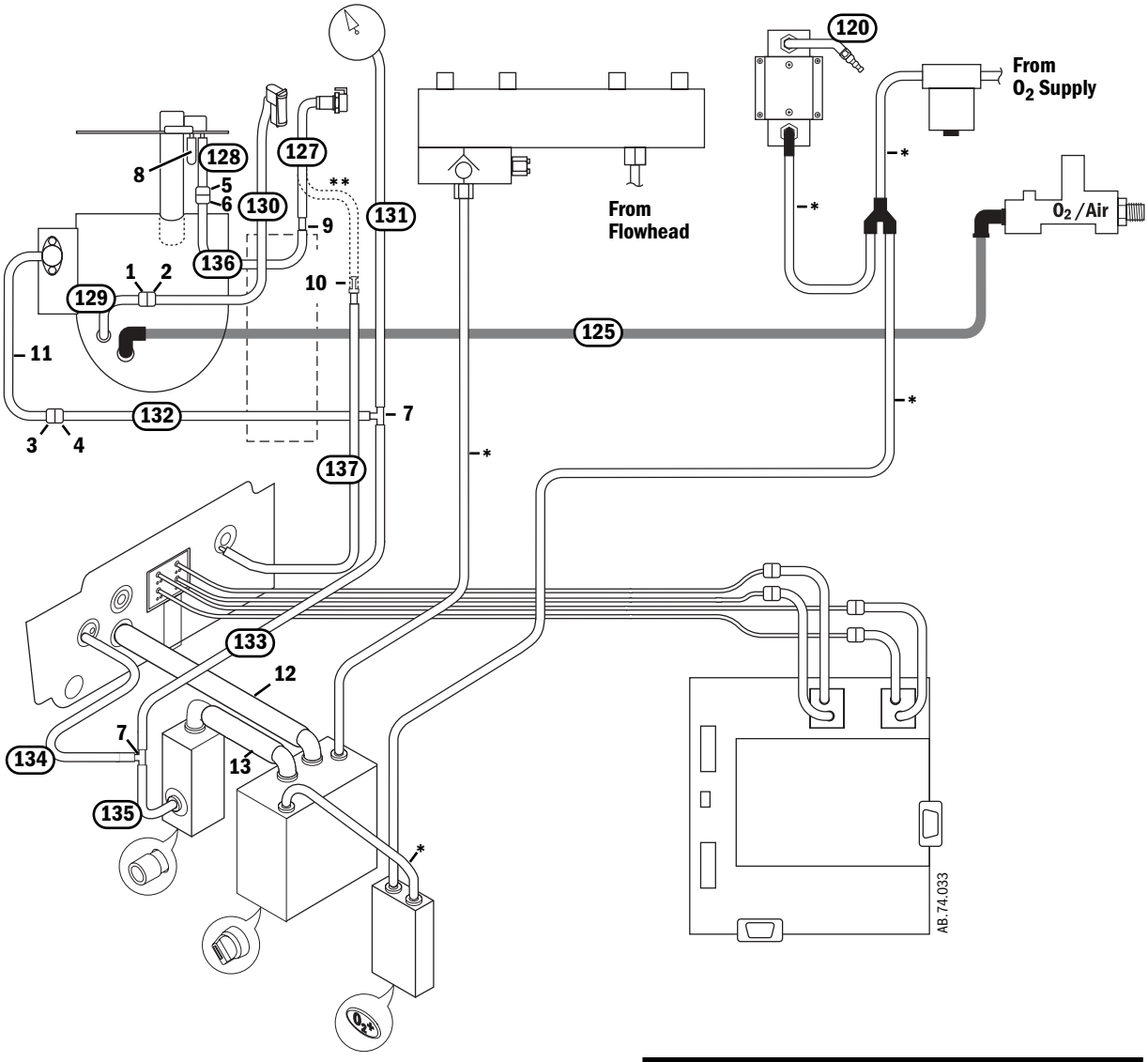
Note: Not every fitting is used in all machines.

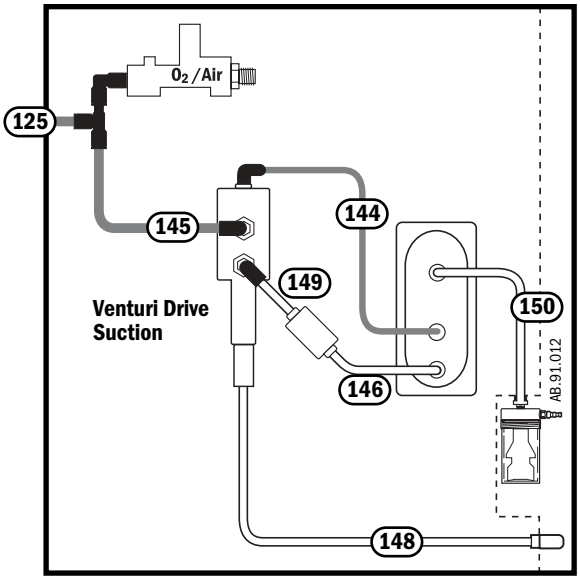
8.25 Vent Drive and low-pressure tubing

Item	Description		Length — Size	Stock Number
1	Coupler, female - black			1503-3128-000
2	Coupler, male - black			1503-3237-000
3	Coupler, female - white			1503-3119-000
4	Coupler, male - white			1503-3236-000
5	Coupler, female - yellow			1503-3132-000
6	Coupler, male - yellow			1503-3131-000
7	Tee (male barb)			1009-3011-000
8	Cap, plug			1406-3524-000
9	Fitting, coupler barb ends			1009-3077-000
10	Plug, 4-mm			1006-3530-000
11	Tubing, low-pressure		151 mm - 1/4 inch	1605-1001-000
12	Tubing (silicone)		72 mm - 3/8 inch	1009-3164-000
13	Tubing (silicone)		42 mm - 3/8 inch	1009-3164-000
	Tube Markings (factory build only)		**Length — Size**	
125	VENT DRIVE	(black)	900 mm - 8 mm	1009-3296-000
120	Aux O2 OUT	(low-pressure)	250 mm - 1/4 inch	1605-1001-000
127	RGM return	(low-pressure)	750 mm - 1/4 inch	1605-1001-000
128	unmarked	(low-pressure)	300 mm - 1/4 inch	1605-1001-000
129	unmarked	(low-pressure)	151 mm - 1/4 inch	1605-1001-000
130	AGSS flowtube	(low-pressure)	750 mm - 1/4 inch	1605-1001-000
131	PAW	(low-pressure)	600 mm - 1/4 inch	1605-1001-000
132	PAW	(low-pressure)	260 mm - 1/4 inch	1605-1001-000
133	PAW	(low-pressure)	330 mm - 1/4 inch	1605-1001-000
134	unmarked	(low-pressure)	25 mm - 1/4 inch	1605-1001-000
135	unmarked	(low-pressure)	50 mm - 1/4 inch	1605-1001-000
136	RGM to Scavenge	(low-pressure)	200 mm - 1/4 inch	1605-1001-000
137	RGM to Circuit	(low-pressure)	300 mm - 1/4 inch	1605-1001-000
144	Venturi Pilot	(black)	330 mm - 4 mm	1009-3363-000
145	Venturi Drive	(black)	300 mm - 8 mm	1009-3296-000
146	unmarked	Tygon	260 mm - 1/2 inch	6700-0005-300
148	unmarked	Tygon	465 mm - 1/2 inch	6700-0005-300
149	unmarked		40 mm - 8 mm	1001-3063-000
150	unmarked	Tygon	180 mm - 1/2 inch	6700-0005-300

*Refer to section 8.26

** Sample gas return is directed to the scavenging system as a factory default. A qualified service representative can reroute the sample gas back to the breathing system (refer to Section 4.13).


120
From
O_2 Supply
O_2 / Air
From
Flowhead
128
127
130
131
136
129
125
132
137
133
134
135
AB.74.033


O_2 / Air
125
145
144
149
150
146
148
Venturi Drive
Suction
AB.91.012

8.26 Tubing for use with Legris fittings

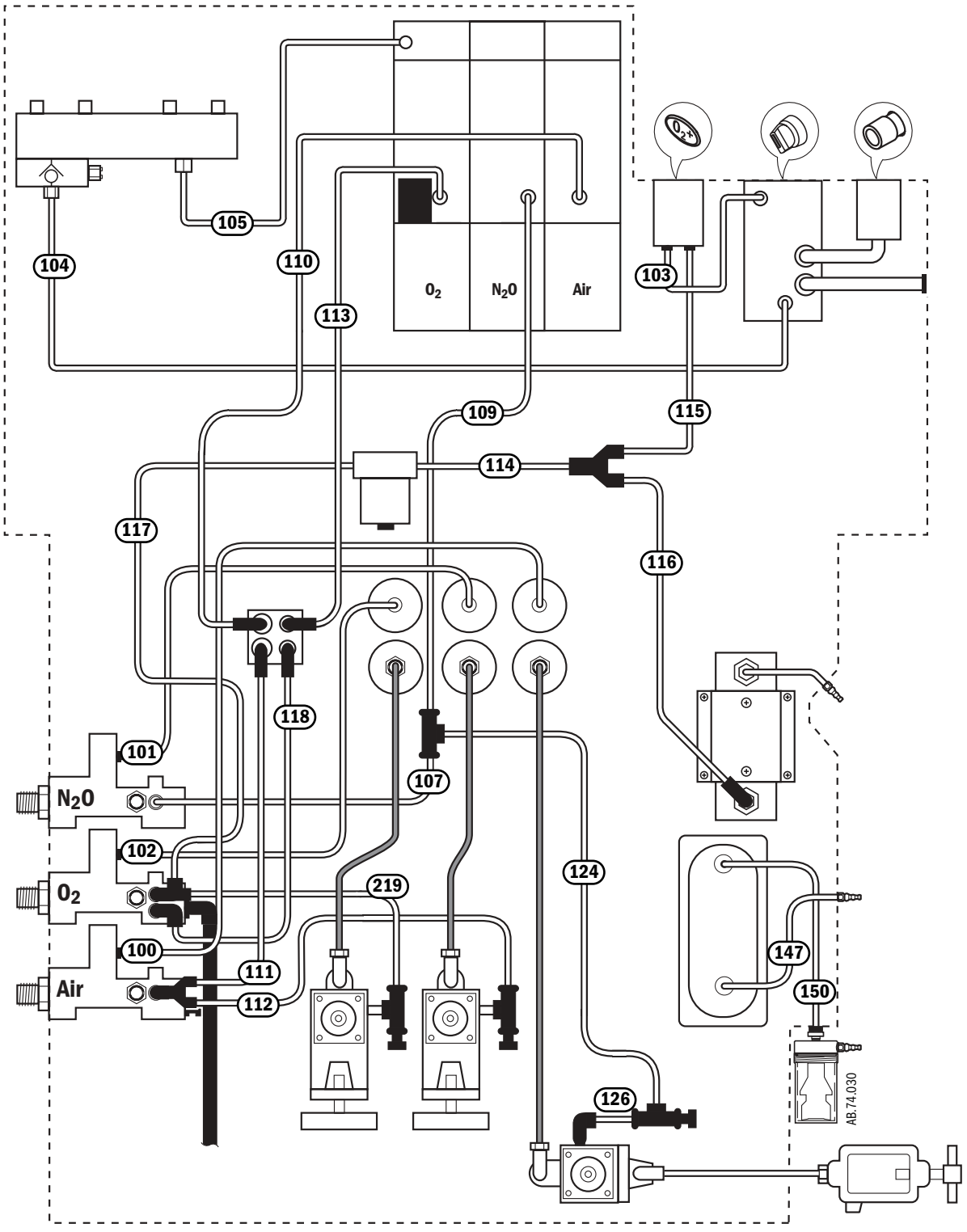
Except for the Tygon tubing (Items 147 and 150), this tubing is a flexible, Nylon-type tubing for use with quick-release fittings.

Item	Description	Length — Size	Stock Number
106*	N2O PLINE - N2O FLWMOD	1200 mm - 4 mm	1001-3060-000
107*	N2O PLINE - N2O CYL	430 mm - 4 mm	1001-3060-000
108**	UNMARKED	40 mm - 4 mm	1001-3060-000
109*	N2O CYL - N2O FLWMOD	800 mm - 4 mm	1001-3060-000
124**	Unmarked	250 mm - 4 mm	1001-3060-000
126	Unmarked	50 mm - 4 mm	1001-3060-000
113	SW4-O2 FLWMOD	1350 mm - 6 mm	1001-3062-000
114	REGULATED O2	400 mm - 6 mm	1001-3062-000
115	REGULATED O2	600 mm - 6 mm	1001-3062-000
116	REGULATED O2	250 mm - 6 mm	1001-3062-000
117	O2 PLINE - REG IN	330 mm - 6 mm	1001-3062-000
118	O2 PLINE - O2 SW3	270 mm - 6 mm	1001-3062-000
123***	unmarked	175 mm - 6 mm	1001-3062-000
219	O2 CYL - O2 PLINE	215 mm - 6 mm	1001-3062-000
111	AIR PLINE - AIR SW3	460 mm - 8 mm	1001-3063-000
110	SW4-AIR FLWMOD	1350 mm - 8 mm	1001-3063-000
112	AIR CYL- AIR PLINE	270 mm - 8 mm	1001-3063-000
100	AIR PLINE - AIR GAGE	470 mm - 1/8 inch	1006-3718-000
101	N2O PLINE - N2O GAGE	470 mm - 1/8 inch	1006-3718-000
102	O2 PLINE - O2 GAGE	470 mm - 1/8 inch	1006-3718-000
104	VAP OUT- ACGO	840 mm - 1/4 inch	1001-3064-000
105	FLWMOD-VAP IN	840 mm - 1/4 inch	1001-3064-000
103	FLUSH VLV-ACGO	280 mm - 1/4 inch	1001-3064-000
147	unmarked (Tygon)	290 mm - 1/2 inch	6700-0005-300
150	unmarked (Tygon)	180 mm - 1/2 inch	6700-0005-300

* With no N_2O cylinder supply, Items 107 and 109 are replaced with Item 106.

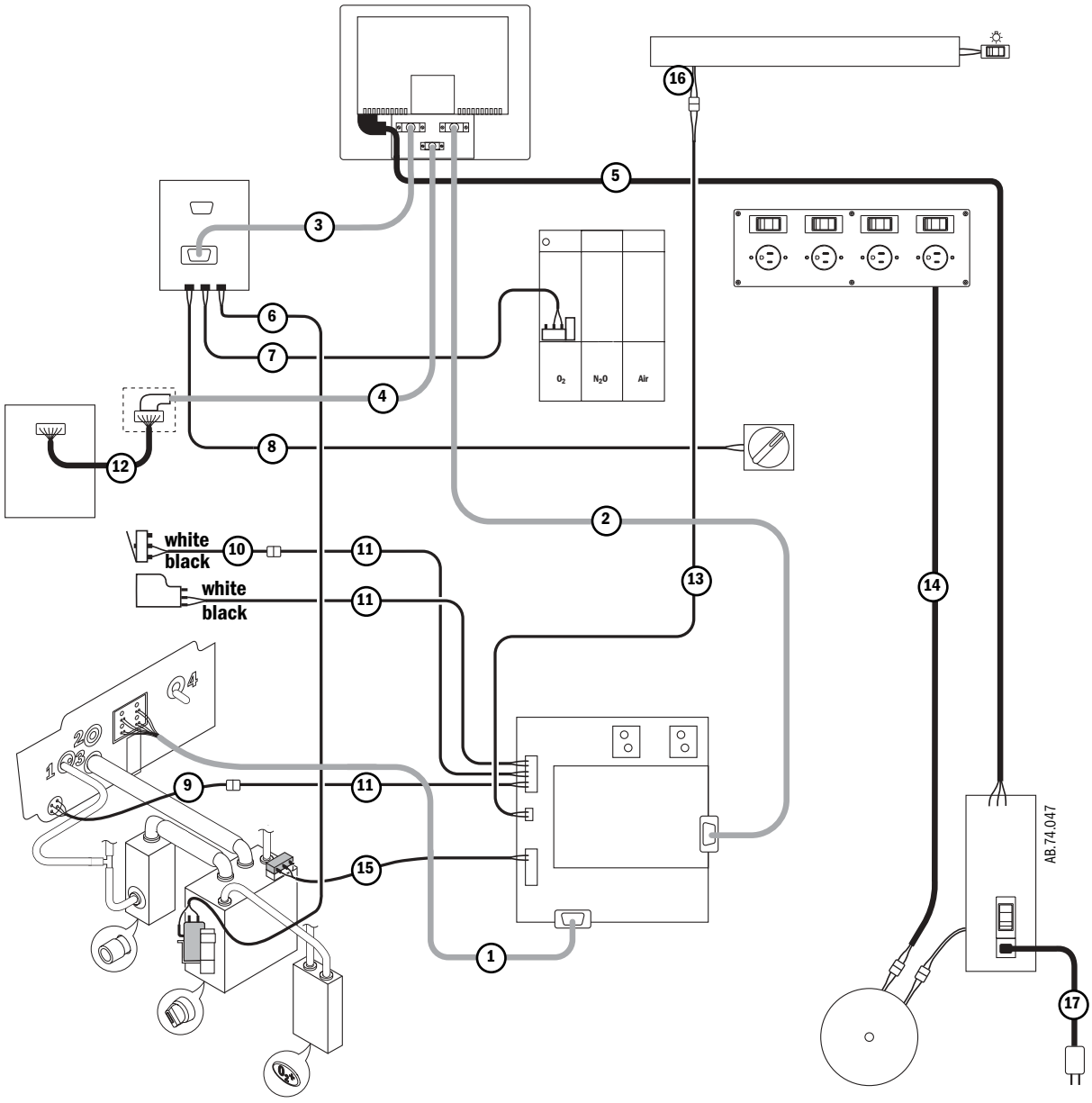
** With an inboard N_2O cylinder supply, Items 124 is replaced with Item 108.

*** With two inboard O_2 cylinder supplies, Item 123 connects the second O_2 cylinder supply to the first O_2 cylinder supply.


105
104
110
113
O_2
N_2O
Air
103
109
115
114
117
116
118
101
107
N_2O
102
O_2
219
124
100
Air
111
112
147
150
126
AB.74.030

8.27 Cables and harnesses

Item	Description	Stock Number
1	Harness, Vent Monitoring board to ABS flow sensors (includes tubing)	1009-8165-000
2	Cable, Vent Monitoring board	1504-5604-000
3	Cable, Serial Isolation	1009-5691-000
4	Cable, Pneumatic Vent Engine	1504-5605-000
5	Cable, power	1009-5711-000
6	Harness, Serial ISO to O2 flush SW	1009-5567-000
7	Harness, Serial ISO to O2 supply SW	1009-5568-000
8	Harness, Serial ISO to on/ standby SW	1009-5566-000
9	Harness, O2 CELL TO FTLR BRD HARN	1009-5586-000
10	Harness, BAG TO VENT SW TO HARN FTLR BRD	1009-5585-000
11	Harness, FLTR BRD TO B/S O2 SNSR AND SW	1009-5531-000
12	Harness, VENT ENG BRD TO CONN PLATE	1009-5545-000
13	Harness, Vent Mon Brd to Task Light	1009-5533-000
14	Harness, to 100/120 V outlets Harness, to 220/240 V outlets	1009-5716-000 1009-5717-000
15	Harness, ACGO Switch	1009-5762-000
16	Harness, Task Light	1009-5584-000
17	Power Cord	Refer to section 8.14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10
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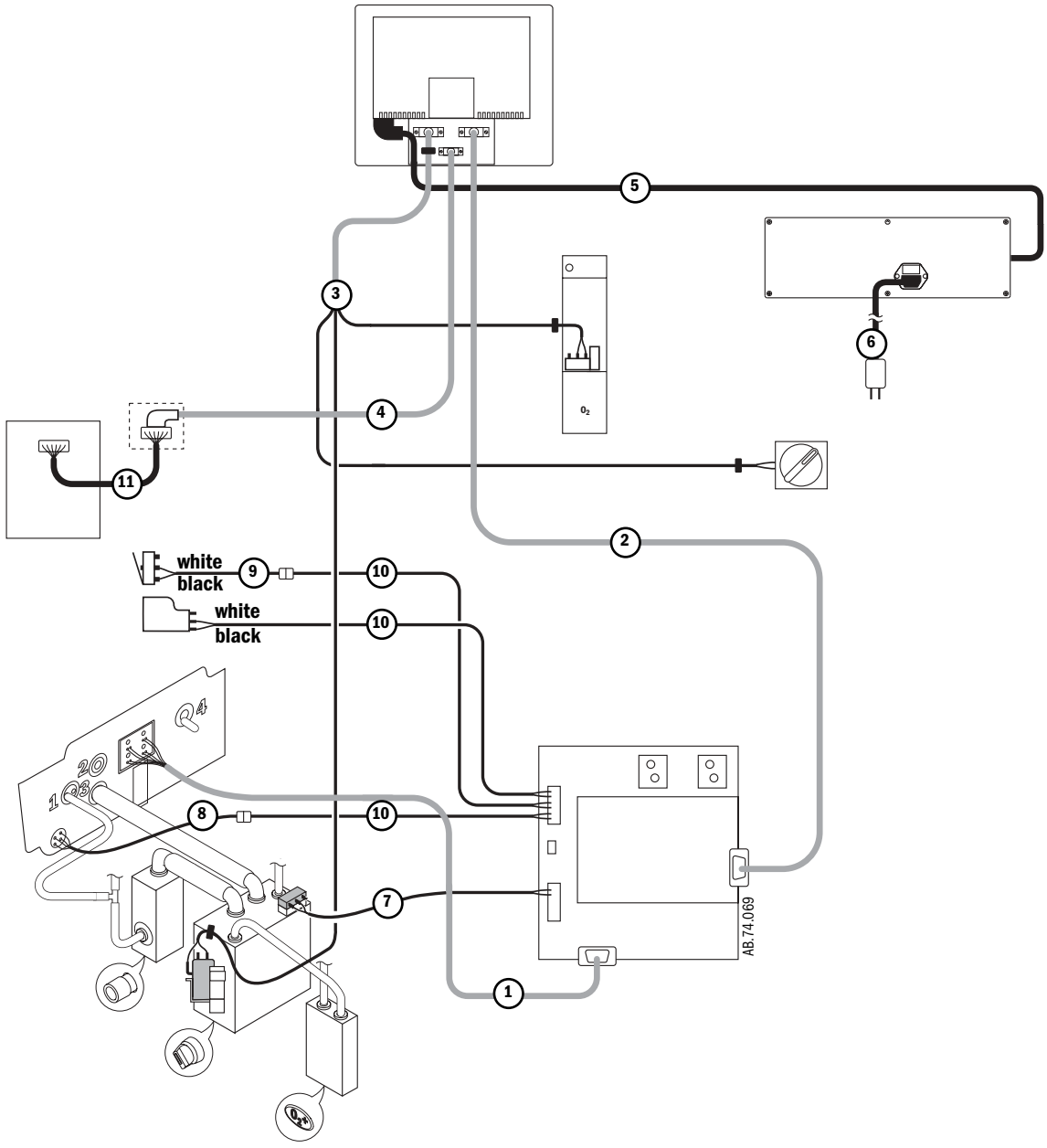
8.28 Cables and harnesses (Aespire 100)

Item	Description	Stock Number
1	Harness, Vent Monitoring board to ABS flow sensors (includes tubing)	1009-8165-000
2	Cable, Vent Monitoring board	1504-5604-000
3	Cable, 7100 module to machine switches	1009-6060-000
4	Cable, Pneumatic Vent Engine	1504-5605-000
5	Cable, power to Control module	1009-5711-000
6	Power Cord, machine	Refer to section 8.14
7	Harness, ACGO Switch	1009-5762-000
8	Harness, O2 CELL TO FTLR BRD HARN	1009-5586-000
9	Harness, BAG TO VENT SW TO HARN FTLR BRD	1009-5585-000
10	Harness, FLTR BRD TO B/S O2 SNSR AND SW	1009-5531-000
11	Harness, VENT ENG BRD TO CONN PLATE	1009-5545-000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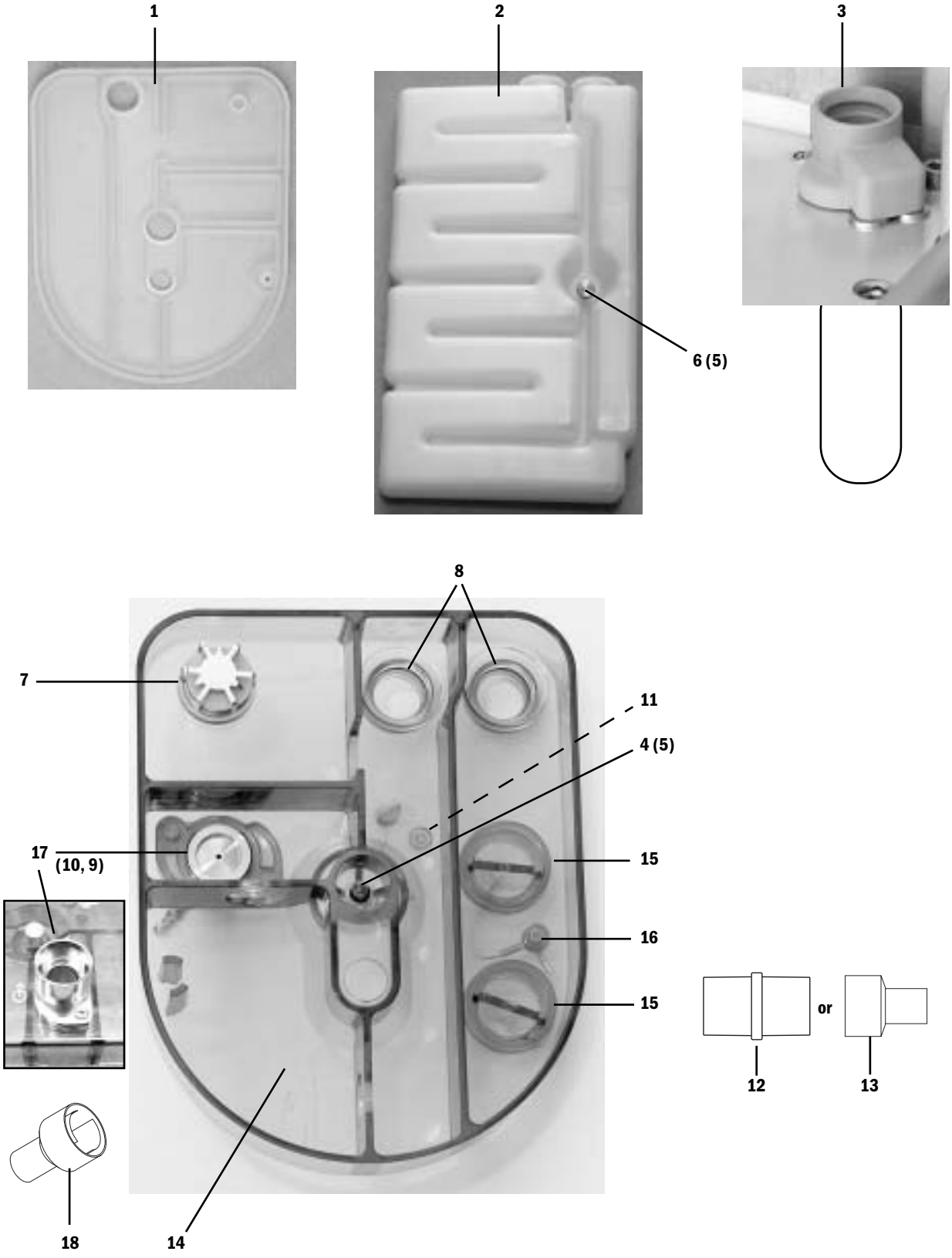
8.29 Anesthetic Gas Scavenging System — AGSS

8.29.1 Passive AGSS

Items 1 through 12 are included in all AGSS kits.

Item	Description, Common Parts	Stock Number	Qty
1	Seal, Receiver Body	1407-3901-000	
2	Reservoir	1407-3903-000	
3	Seal and scavenging down-tube	1407-3904-000	
4	Thumbscrew, M6x28.5	1406-3305-000	
5	O-ring, 4.42 ID, 9.65 OD	1407-3923-000	(2)
6	Thumbscrew, M6x43	1406-3304-000	
7	Valve, unidirectional (negative pressure relief)	1406-8219-000	
7a	Seat, Valve, Negative Pressure	1406-3396-000	
7b	Retainer, disc	1400-3017-000	
*7c	O-ring, 20.35 ID, 23.90 OD	1406-3397-000	
7d	Disc, check-valve	0210-5297-100	
8*	O-ring, 22 ID, 30 OD silicone	1407-3104-000	(2)
9*	O-ring, 21.95 ID, 25.51 OD	1406-3558-000	
10	Screw, M4x8	9211-0640-083	(2)
11	Cap, 3.18 Barb, Silicone	1406-3524-000	
12	Adapter, auxiliary inlet, 30-mm male to 30-mm male	M1003134	
13	Adapter, auxiliary inlet, 30-mm male to 19-mm male	M1003947	
Passive AGSS Specific Parts			
14	Receiver, Passive/Adjustable	1407-3908-000	
15	Plug Assembly, tethered	1407-3909-000	(2)
16	Screw, shoulder M3	1407-3915-000	
17	Connector, 30-mm ISO, Male	1406-3555-000	
18	Adapter, scavenging, 30-mm female to 19-mm male	1500-3376-000	(5 pack)

* Lubricate sparingly with Krytox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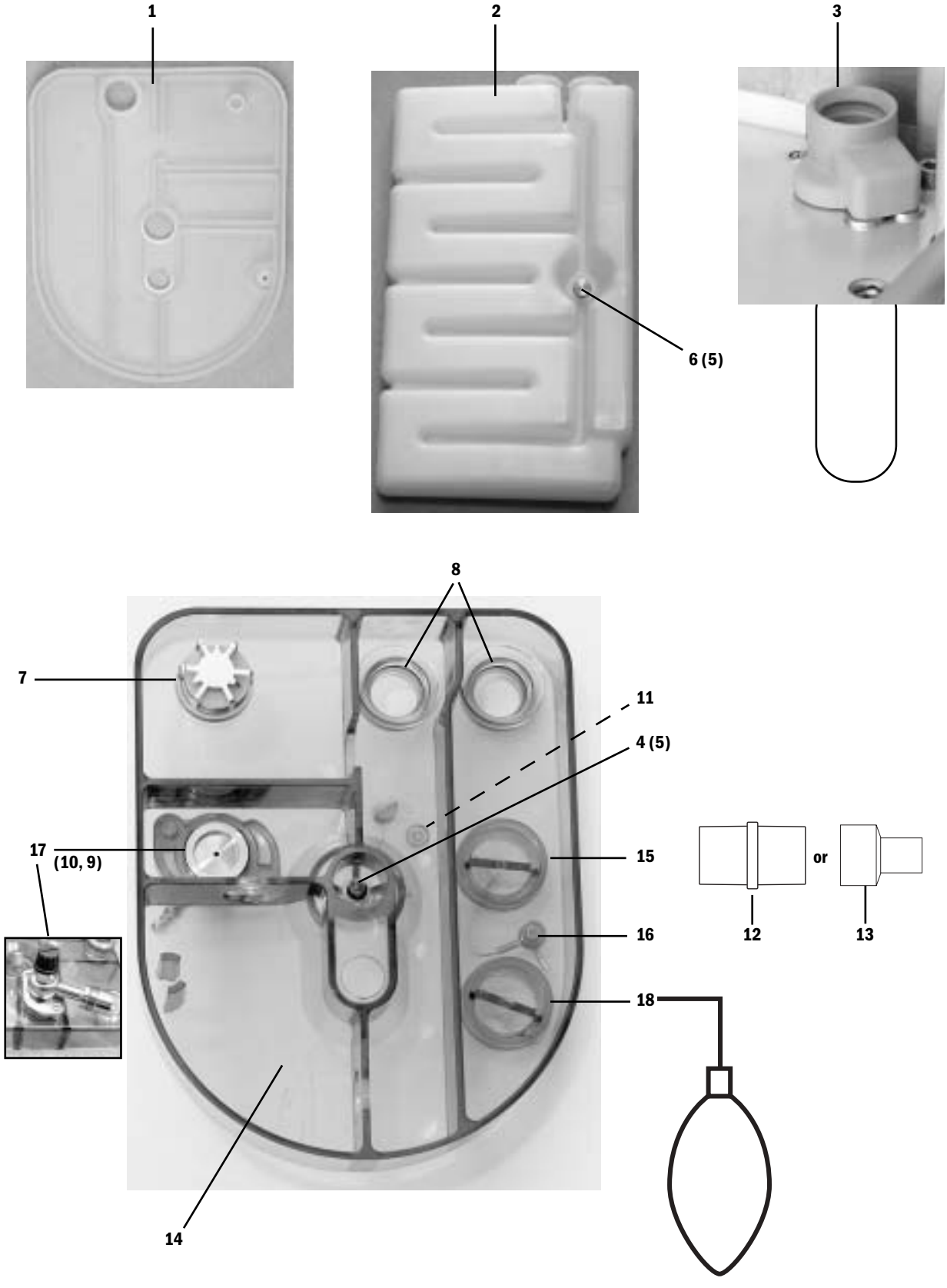
8.29.2 Adjustable AGSS

Items 1 through 12 are included in all AGSS kits.

Item	Description, Common Parts	Stock Number	Qty
1	Seal, Receiver Body	1407-3901-000	
2	Reservoir	1407-3903-000	
3	Seal and scavenging down-tube	1407-3904-000	
4	Thumbscrew, M6x28.5	1406-3305-000	
5	O-ring, 4.42 ID, 9.65 OD	1407-3923-000	(2)
6	Thumbscrew, M6x43	1406-3304-000	
7	Valve, unidirectional (negative pressure relief)	1406-8219-000	
7a	Seat, Valve, Negative Pressure	1406-3396-000	
7b	Retainer, disc	1400-3017-000	
*7c	O-ring, 20.35 ID, 23.90 OD	1406-3397-000	
7d	Disc, check-valve	0210-5297-100	
8*	O-ring, 22 ID, 30 OD silicone	1407-3104-000	(2)
9*	O-ring, 21.95 ID, 25.51 OD	1406-3558-000	
10	Screw, M4x8	9211-0640-083	(2)
11	Cap, 3.18 Barb, Silicone	1406-3524-000	
12	Adapter, auxiliary inlet, 30-mm male to 30-mm male	M1003134	
13	Adapter, auxiliary inlet, 30-mm male to 19-mm male	M1003947	
Adjustable AGSS Specific Parts			
14	Receiver, Passive/Adjustable	1407-3908-000	
15	Plug Assembly, tethered	1407-3909-000	
16	Screw, shoulder M3	1407-3915-000	
17	Needle Valve Assembly (with DISS EVAC connector)	1407-3918-000	
18	Bag with 30 mm male connector	8004460	

* Lubricate sparingly with Krytox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or
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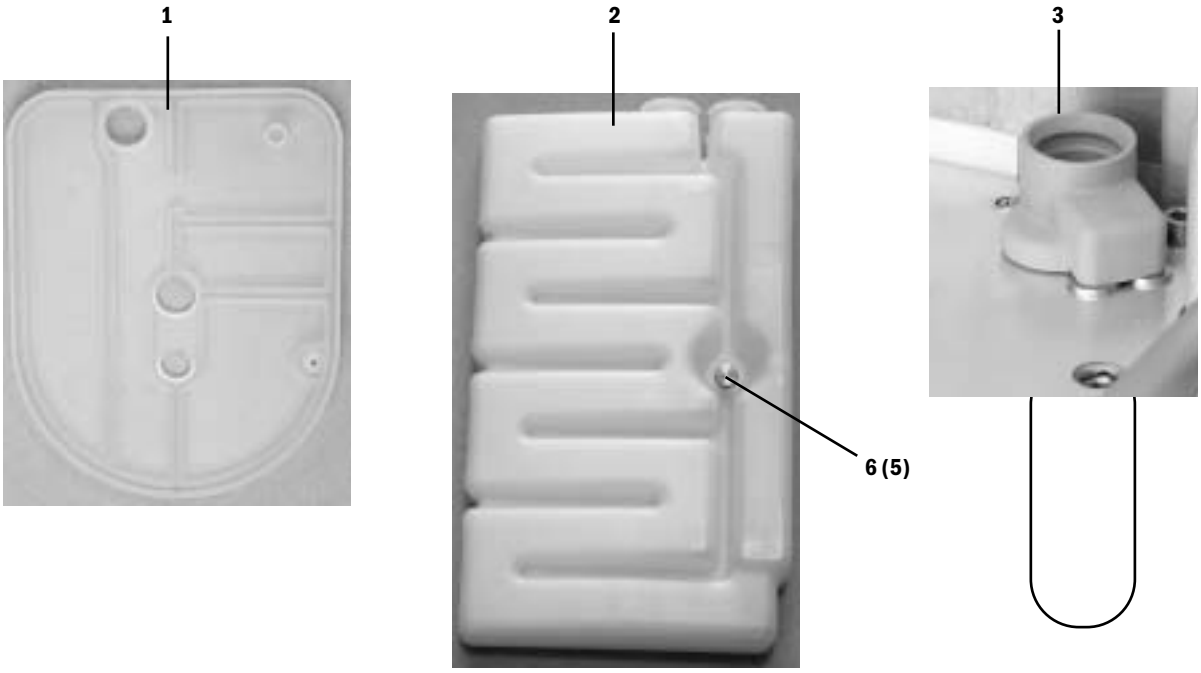
8.29.3 Active AGSS

Items 1 through 12 are included in all AGSS kits.

Item	Description, Common Parts	Stock Number	Qty
1	Seal, Receiver Body	1407-3901-000	
2	Reservoir	1407-3903-000	
3	Seal and scavenging down-tube	1407-3904-000	
4	Thumbscrew, M6x28.5	1406-3305-000	
5	O-ring, 4.42 ID, 9.65 OD	1407-3923-000	(2)
6	Thumbscrew, M6x43	1406-3304-000	
7	Valve, unidirectional (negative pressure relief)	1406-8219-000	
7a	Seat, Valve, Negative Pressure	1406-3396-000	
7b	Retainer, disc	1400-3017-000	
*7c	O-ring, 20.35 ID, 23.90 OD	1406-3397-000	
7d	Disc, check-valve	0210-5297-100	
8*	O-ring, 22 ID, 30 OD silicone	1407-3104-000	(2)
9*	O-ring, 21.95 ID, 25.51 OD	1406-3558-000	
10	Screw, M4x8	9211-0640-083	(2)
11	Cap, 3.18 Barb, Silicone	1406-3524-000	
12	Adapter, auxiliary inlet, 30-mm male to 30-mm male	M1003134	
13	Adapter, auxiliary inlet, 30-mm male to 19-mm male	M1003947	
Active AGSS Specific Parts			
14	Receiver, with air brake	1407-3900-000	
15	Seal, for filter and orifice	1407-3902-000	(2)
16	Filter	1406-3521-000	
Active High Flow Specific Parts			
17a	Connector, high flow M30 thread	1406-3557-000	
18	Orifice, high flow	1407-3920-000	
Active Low Flow with EVAC connector Specific Parts			
17b	Connector, low flow EVAC	1406-3597-000	
18	Orifice, low flow	1407-3919-000	
Active Low Flow with 25 mm connector Specific Parts			
17c	Connector, low flow 25 mm	1406-3573-000	
18	Orifice, low flow	1407-3919-000	
Active Low Flow with 12.7 mm hose barb connector Specific Parts			
17d	Connector, low flow 12.7 mm (1/2 inch)	1406-3574-000	
18	-none-		
Active Low Flow with 30 mm ISO male connector Specific Parts			
17e	Connector, low flow 25 mm	1406-3555-000	
18	Orifice, low flow	1407-3919-000	

* Lubricate sparingly with Krytox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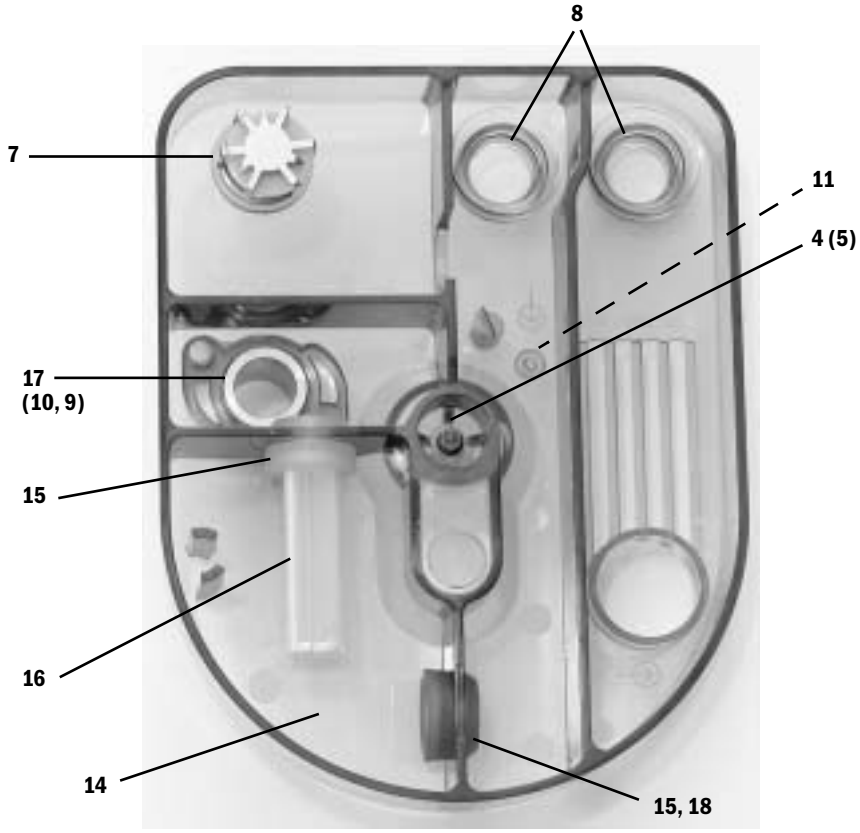
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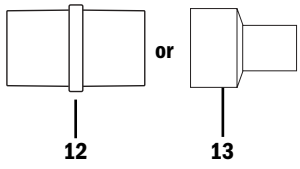
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17a
17b
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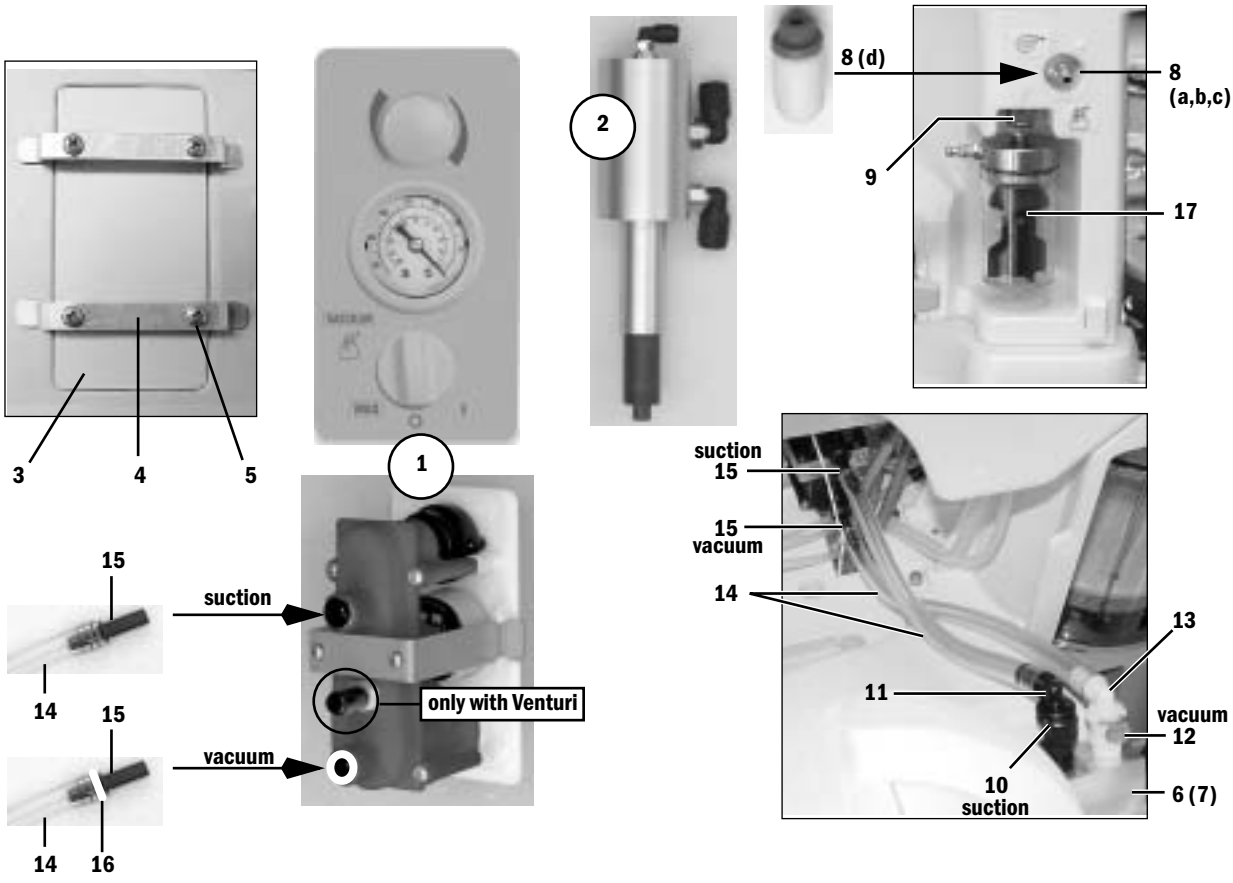
17d
17e

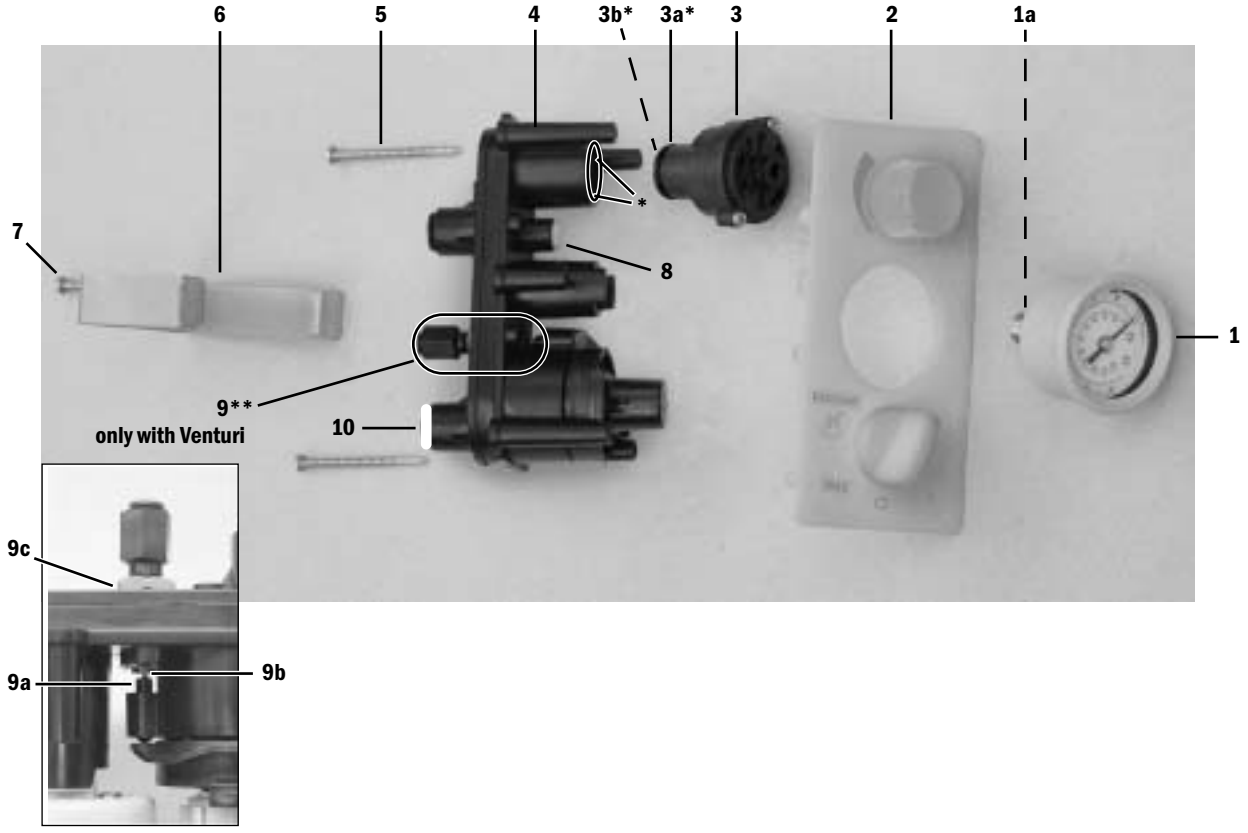
8.30 Integrated Suction Regulator

8.30.1 Major Components (Continuous and Venturi suction)



Item	Description	Stock Number
1	Suction Control Module	Refer to section 8.30.2
2	Venturi Assembly	Refer to section 8.30.3
3	Cover, blank (if no Suction)	1009-3271-000
4	Bracket, blank cover mounting	1009-3270-000
5	Screw, M4x10 self-tapping	1009-5534-000
6	Manifold	1009-3123-000
7	Screw, M5x20 BHSCS PT THD FORMING	1009-3384-000
8a	Connector, NIST	1011-3524-000
8b	Connector, Barb	0221-0702-300
8c	Connector, Air Liquide	1009-8292-000
8d	Muffler, for Venturi Drive	1011-3511-000
9	Coupling, Colder insert metal	1009-3135-000
10	Coupling, Colder body black	1009-3373-000
11	Coupling, Colder insert black	1009-3374-000
12	Coupling, Colder body white	1009-3371-000
13	Coupling, Colder insert white	1009-3372-000
14	Tubing, Tygon	Refer to section 8.26
15	Fitting, barb to 8-mm Legris	1009-3137-000
16	Cap, white	1009-3385-000
17	Overflow Safety Trap	6700-0647-000

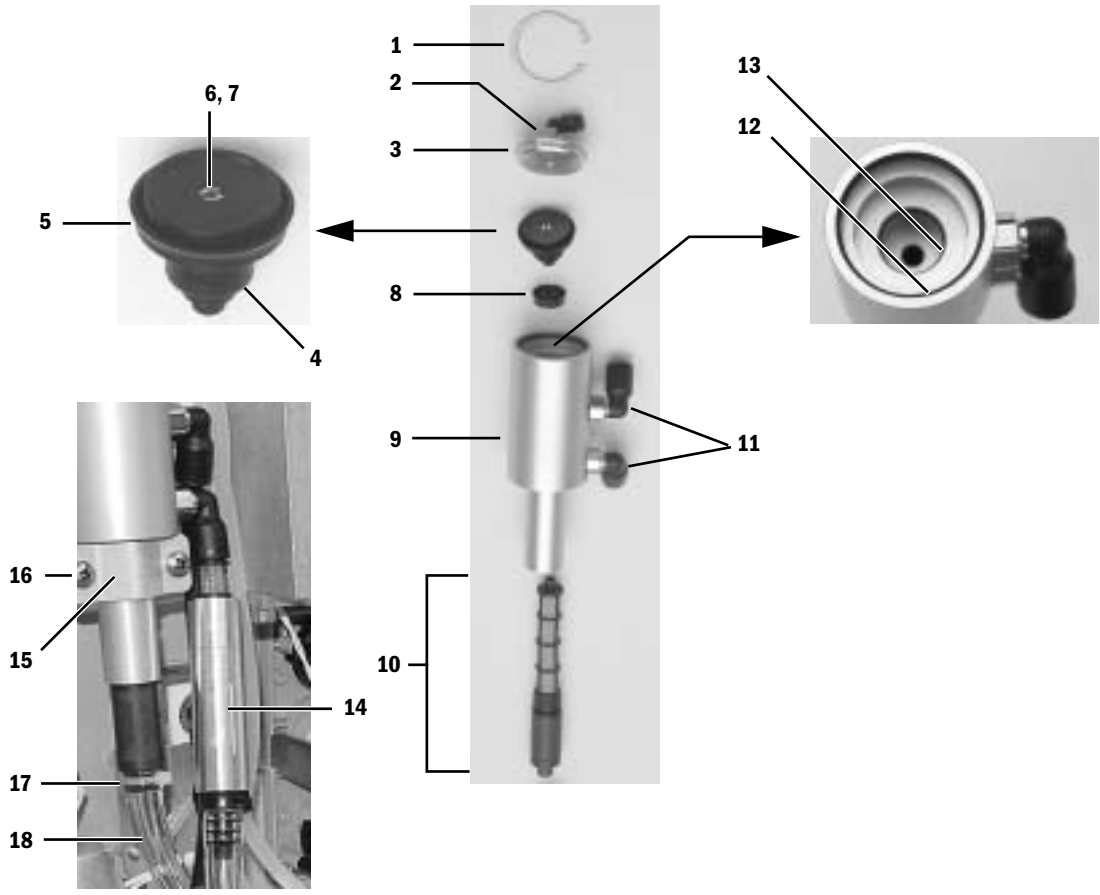
8.30.2 Suction Control Module



Item	Description	Stock Number
1	Gauge, 760 mmHg	1009-3227-000
	Gauge, 1 Bar	1009-3228-000
1a	O-ring, Gauge (included with gauge assy, 2ea. required)	6700-0133-500
2	Control panel assembly, with suction regulator knob and mode control knob	1009-3213-000
3	Regulator Module (plugs into manifold assembly)	6700-1225-800
3a	O-ring, Regulator Module, Large (included with regulator module)	6700-0136-500
3b	O-ring, Regulator Module, Stem (included with regulator module)	0210-0527-300
4	Manifold Assembly, without Gauge and Regulator Module	1009-3277-000
5	Screw, #6 - 2 inch	1009-3340-000
6	Mounting bracket	1009-3255-000
7	Screw, #6 - 1 inch	1009-3339-000
8	Filter	0206-5159-300
9	Pilot valve adapter assembly (includes plunger, jam nut, and valve assembly)	1009-3278-000
10	Cap, white	1009-3192-000

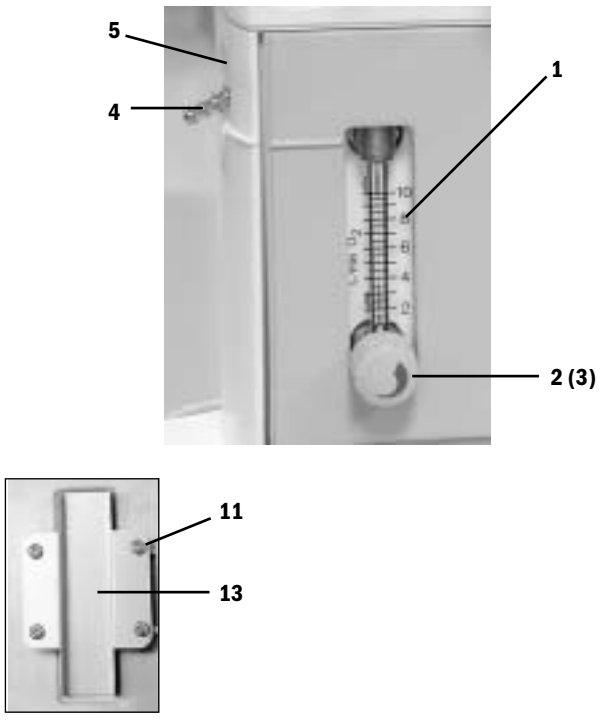
* Lubricate the regulator module o-rings and the mating bore of the manifold sparingly with Dow 111 lubricant.
** Drop the plunger (**9a**), round end first, into the manifold. Thread the pilot valve into the manifold body. Set the mode switch to raise the plunger. Adjust the pilot valve (**9b**) so that the plunger actuates the pilot valve approximately half of its travel. Tighten the jam nut (**9c**).

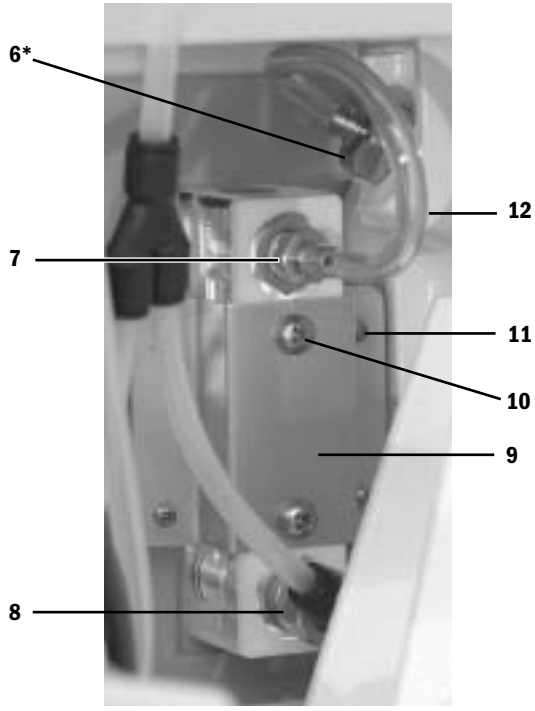
8.30.3 Venturi assembly



Item	Description	Stock Number
1	C-clip retainer, Truarc	1500-3158-000
2	Elbow fitting, 4-mm Legris	1006-3663-000
3	Cap	1011-5002-000
4	Spoppet	1011-5001-000
5	Seal, u-cup large	1503-3090-000
6	Orifice	1011-3508-000
7	Screen, 150 mesh monel	1001-3808-000
8	Seal, u-cup small	1503-3089-000
9	Body	1011-5000-000
10	Venturi	1011-3509-000
11	Elbow fitting, 8-mm Legris	1011-3510-000
12	O-ring, large	9221-3032-116
13	O-ring, small	1503-3108-000
14	Check valve	1011-8002-000
15	Bracket, Venturi mounting	1009-3182-000
16	Screw, M5x20 BHSCS PT THD FORMING	1009-3384-000
17	Cable tie	0203-5915-300
18	Tubing, Tygon	Refer to section 8.25

8.31 Auxiliary O_2 Flowmeter

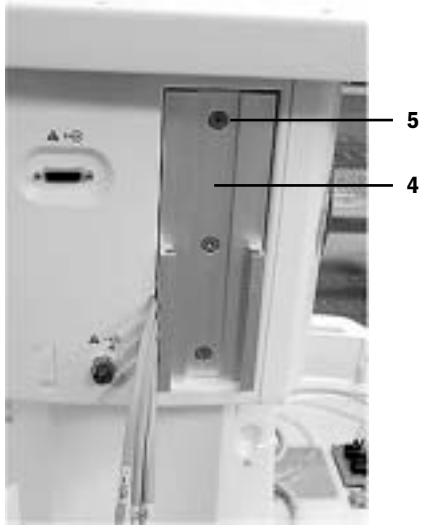


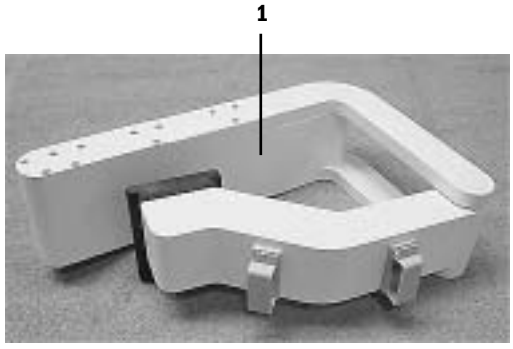


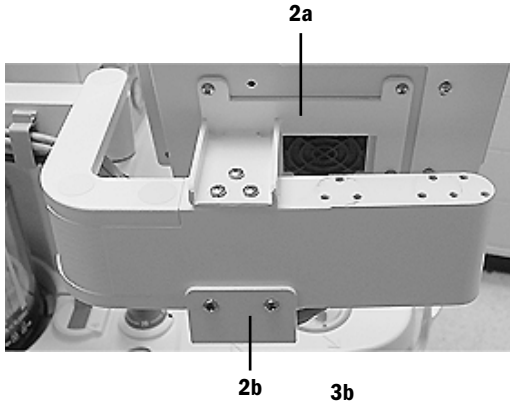
Item	Description	Stock Number
1	Flowmeter, 1-10 L/min, Complete with fittings installed Flowmeter, 1-10 L/min, without fittings	1006-8424-000 1006-3841-000
2	Knob, gray	1011-3471-000
3	Set Screw	9211-0830-053
4	Nipple, Panel-Mount, Auxiliary O_2 Outlet	1006-5177-000
5	Label, blank (if no Auxiliary O_2)	1009-3243-000
6*	Nut, M12x1.75, SST	0144-3132-140
7**	Flowmeter Fitting, 1/8 NPTM straight adapter Flowmeter Fitting, 1/8 NPTM elbow adapter	0204-8877-300 0204-8788-300
8**	Flowmeter Fitting Assembly, 6-mm Tubing Adapter	1006-8423-000
9	Plate, Flowmeter Mounting	1009-3126-000
10	Screw, 10-32 x 3/8	0140-6631-107
11	Screw, M4x10 self-tapping	1009-5534-000
12	Tubing (low-pressure) 250 mm - 1/4 inch	1605-1001-000
13	Plate, blank (if no Auxiliary O_2)	1009-3128-000

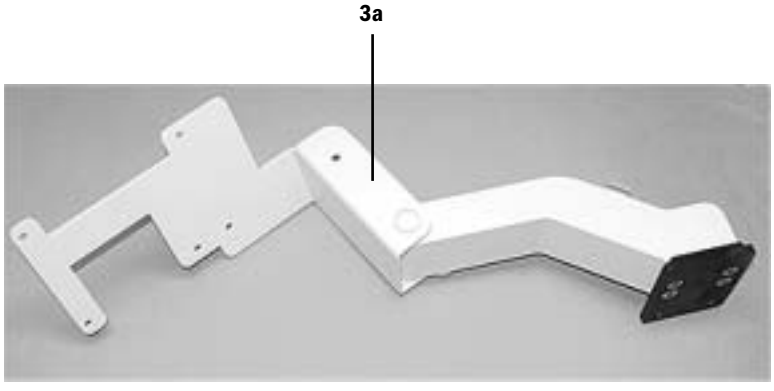
* Apply Loctite 242.
** Apply Teflon tape.

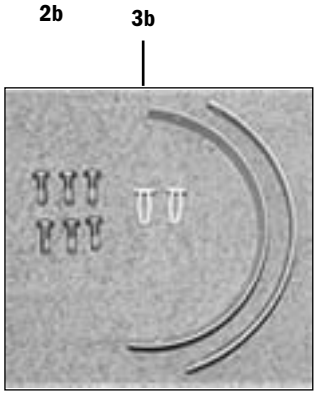
8.32 Display mounts







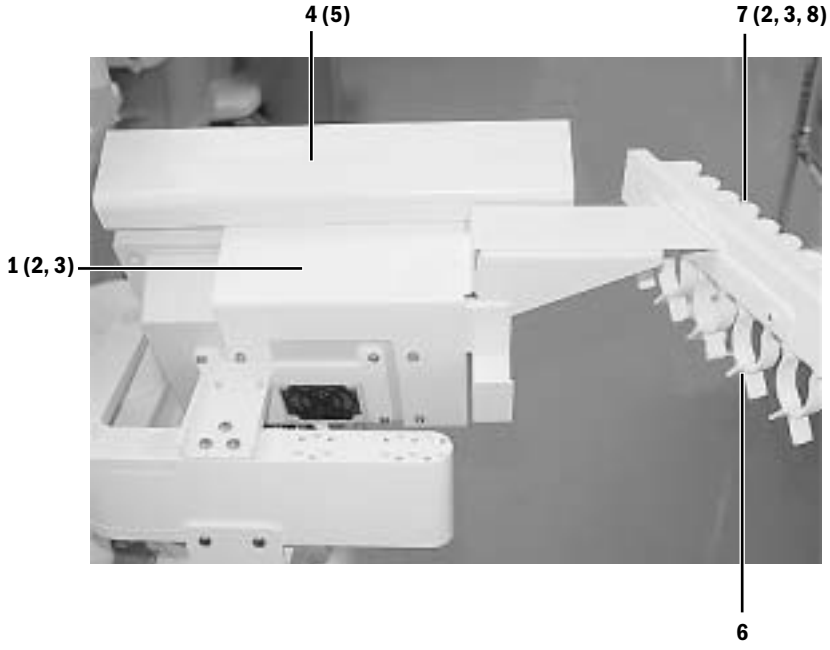




Item	Description	Stock Number
1	GCX Arm Kit, long	1009-3262-000
2	GCX Bracket Kit, includes display mount (2a), cable guard (2b), and mounting hardware	1009-3263-000
3	GCX Arm Kit, short includes display arm (3a) and fasteners (3b)	1009-3264-000
4	Extrusion, upper dovetail	1009-3113-000
5	Screw, M6x20	0144-2131-925
*	Cable ties	0203-5915-300

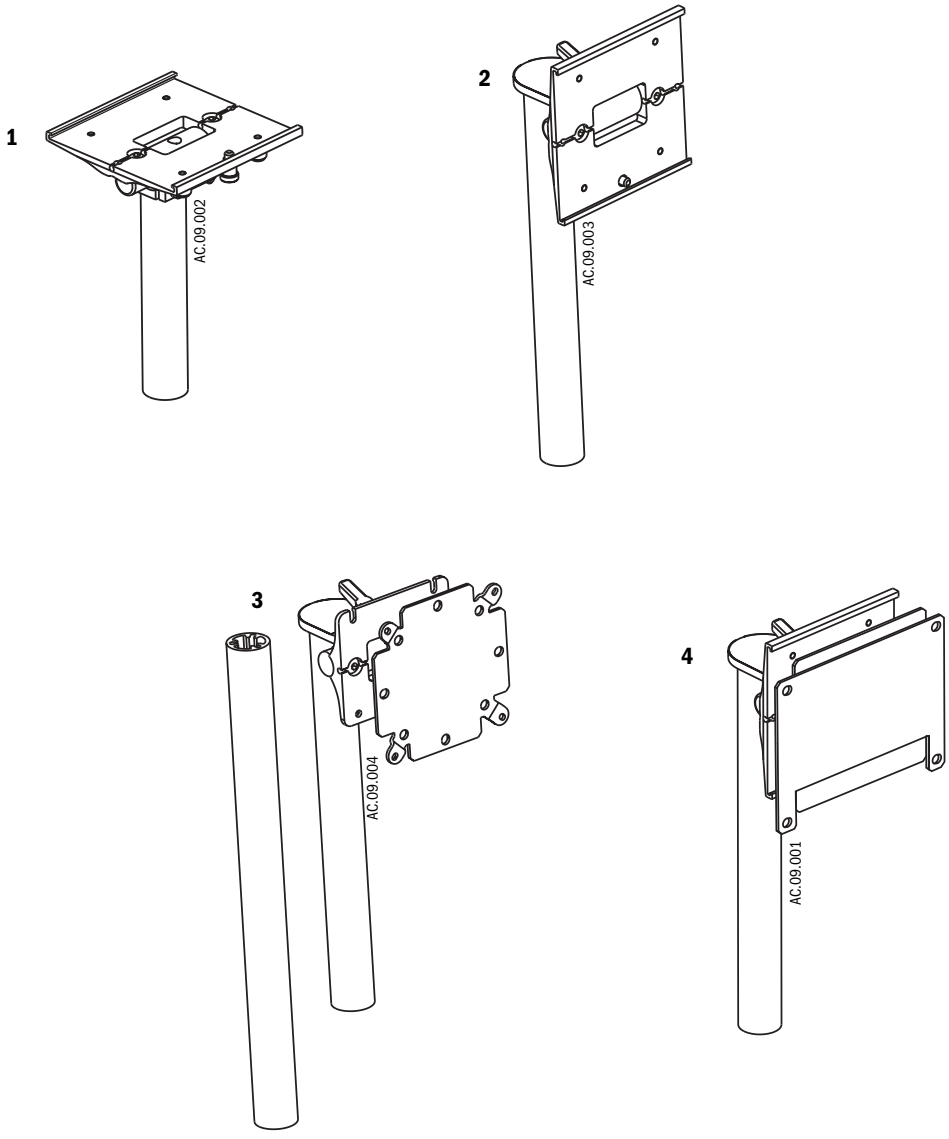
* Refer to Section 4.21 for mounting the display arms and proper cable dressing.

8.33 Cable management arm



Item	Description	Stock Number
	Cable management arm, complete assembly	1009-8181-000
1	Bracket, cable management	1009-3261-000
2	Screw, M4x12	0140-6226-111
3	Lockwasher, M4 external	9213-0540-003
4	Extrusion, cable arm, front loading	1009-3247-000
5	Screw, M4x6 Nyloc	1009-3283-000
6	Retainer, multiple cable	1009-3252-000
7	Retainer, cable small	1009-3259-000
8	Washer, M4 flat	0144-1025-165

8.34 Display arm mounting kits for optional equipment



Item	Description	Stock Number
1	Cardiocap 5 mount	1009-3265-000
2	S/5 Flat Panel mount	1009-3266-000
3	Spacelabs Flat Panel mount	1009-3267-000
4	Spacelabs PC Scout mount	1009-3268-000

9 Schematics and Diagrams

In this section

Schematics are subject to change without notice.

Circuit boards are available only as complete assemblies.

Figure 9-1 System connection block diagram 9-2

Figure 9-2 Gas scavenging circuits 9-3

Figure 9-3 Electrical cabling block diagram 9-4

Figure 9-4 Pneumatic circuit diagram 9-5

Figure 9-5 Wiring harnesses. 9-6

Figure 9-6 Wiring harnesses (Aespire 100). 9-7

Figure 9-7 Tubing 9-8

Figure 9-8 Schematic, AC Inlet module; 100–120 V (Non-isolated outlets or no outlets) 9-9

Figure 9-9 Schematic, AC Inlet module; 100–120 V (Isolated outlets. 9-10

Figure 9-10 Schematic, AC Inlet module; 220–240 V (Non-isolated outlets or no outlets) 9-11

Figure 9-11 Schematic, AC Inlet module; 220–240 V (Isolated outlets) 9-12

Figure 9-12 Schematic, AC Power (Aespire 100) 9-13

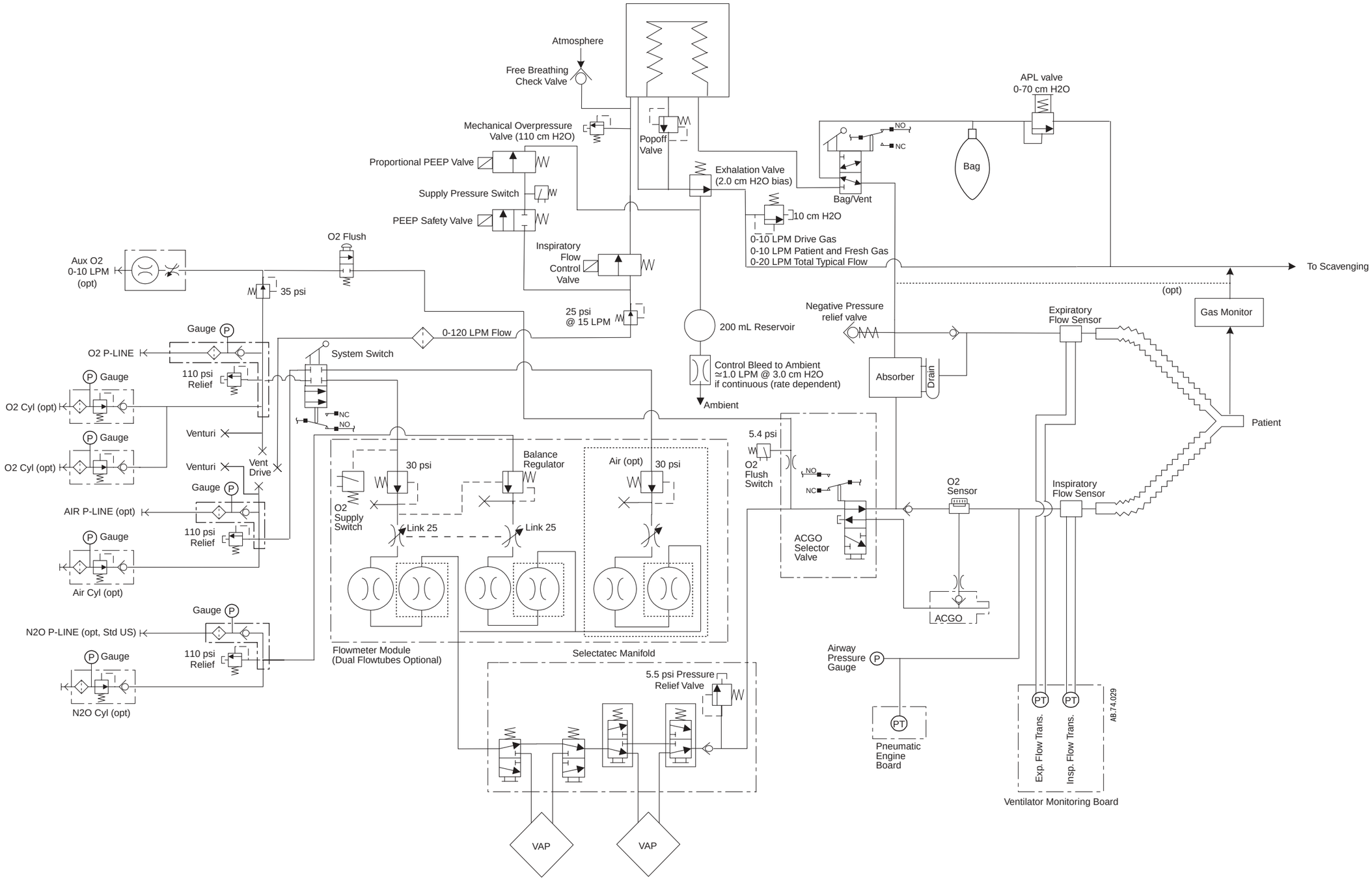
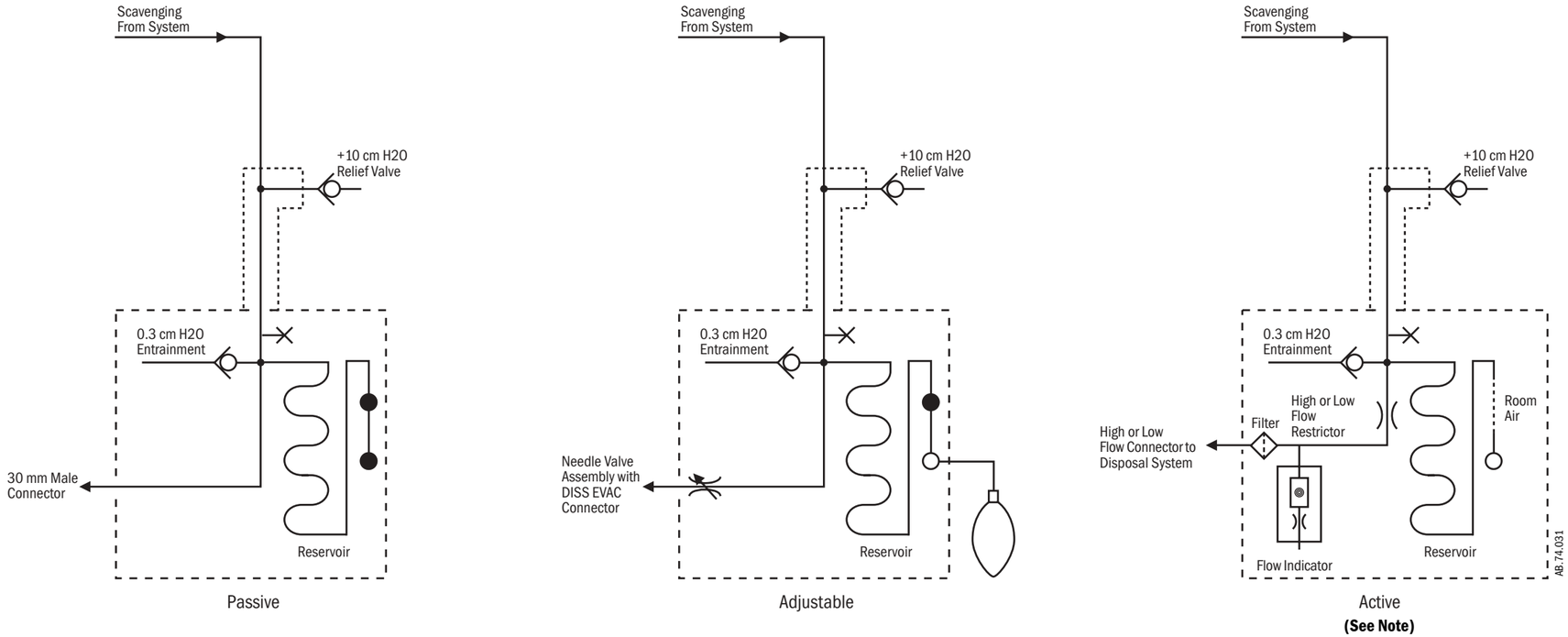


Figure 9-1 • System connection block diagram



Key to Symbols

- ✕ = Plugged port (1/8 inch) for sample gas return
- ● = Plugged port (30 mm) for auxiliary breathing system scavenging
- ○ = Open port (30 mm) for auxiliary breathing system scavenging

Note: Active AGSS systems with a 12.7 mm connector do not include the Flow Restrictor and the Flow Indicator.

Figure 9-2 • Gas scavenging circuits

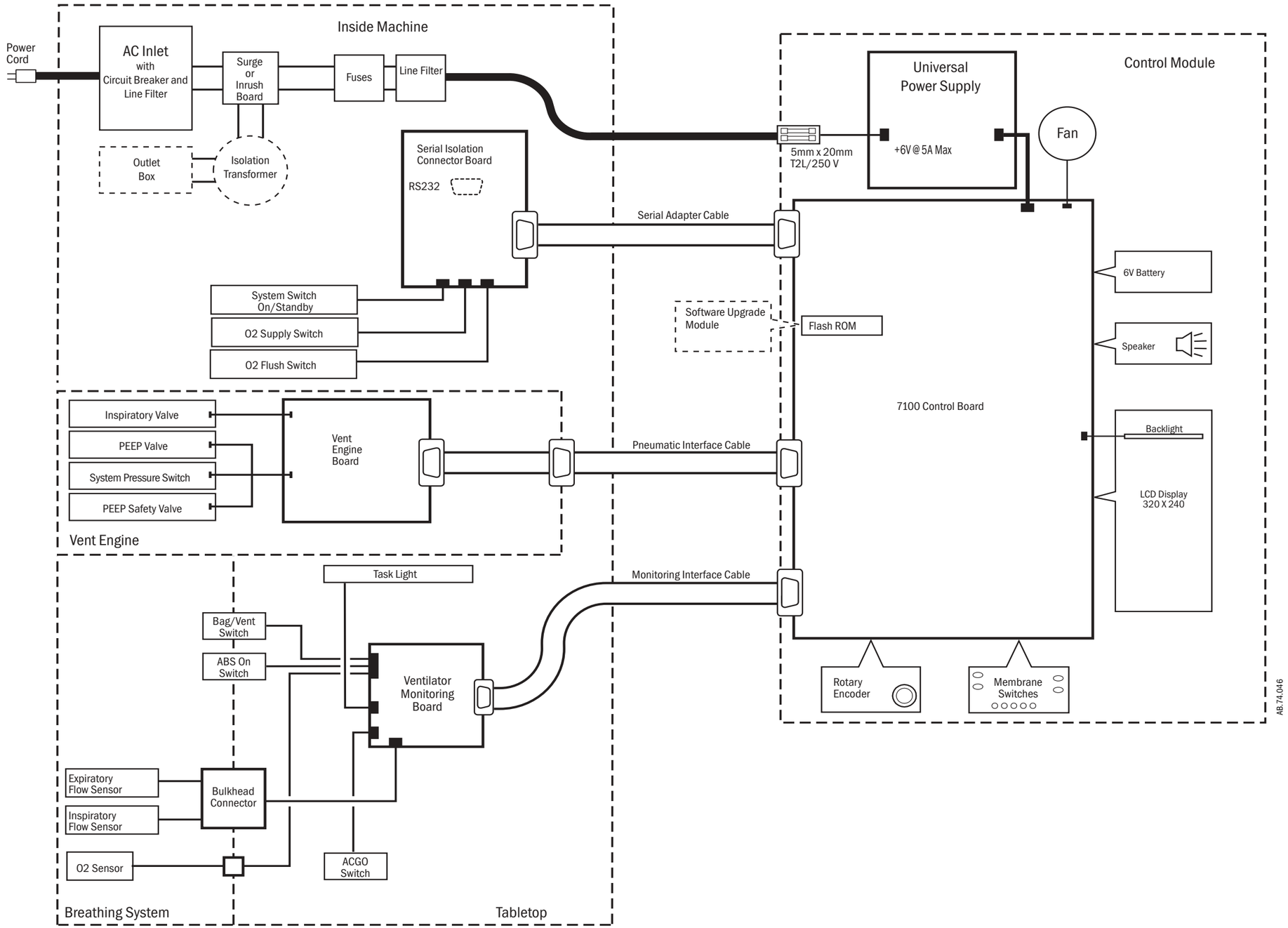


Figure 9-3 • Electrical cabling block diagram

Key to Numbered Components

1. Pipeline pressure gauge
2. Pipeline inlet
3. Cylinder pressure gauge
4. Cylinder inlet
5. Primary regulator (cylinder pressure)
6. High-pressure relief valve (758 kPa / 110 psi)*
7. Supply connections for the ventilator
   a. O_2 drive gas
   b. Air drive gas
8. System switch
9. Switch for low O_2 supply pressure alarm (used with the ventilator)
10. O_2 secondary regulator (207 kPa / 30 psi)*
11. O_2 flow control valve
12. O_2 flow tube(s)
13. O_2 flush and auxiliary flowmeter regulator (241 kPa / 35 psi)*
14. O_2 Flush
    a. Flush valve
    b. Pressure switch (used with the ventilator)
15. N_2O balance regulator
16. N_2O flow control valve
17. N_2O flow tube(s)
18. Air secondary regulator (207 kPa / 30 psi)*
19. Air flow control valve
20. Air flow tube(s)
21. Supply connection for Venturi suction
    a. O_2 drive gas
    b. Air drive gas
22. Vaporizer port valve
23. Vaporizer
24. Low-pressure relief valve (38 kPa / 5.5 psi)*
25. Auxiliary flowmeter (optional)
26. To ABS
27. To ACGO
28. Test port (primary regulator)
29. Test port (secondary/balance regulator)

* Approximate values

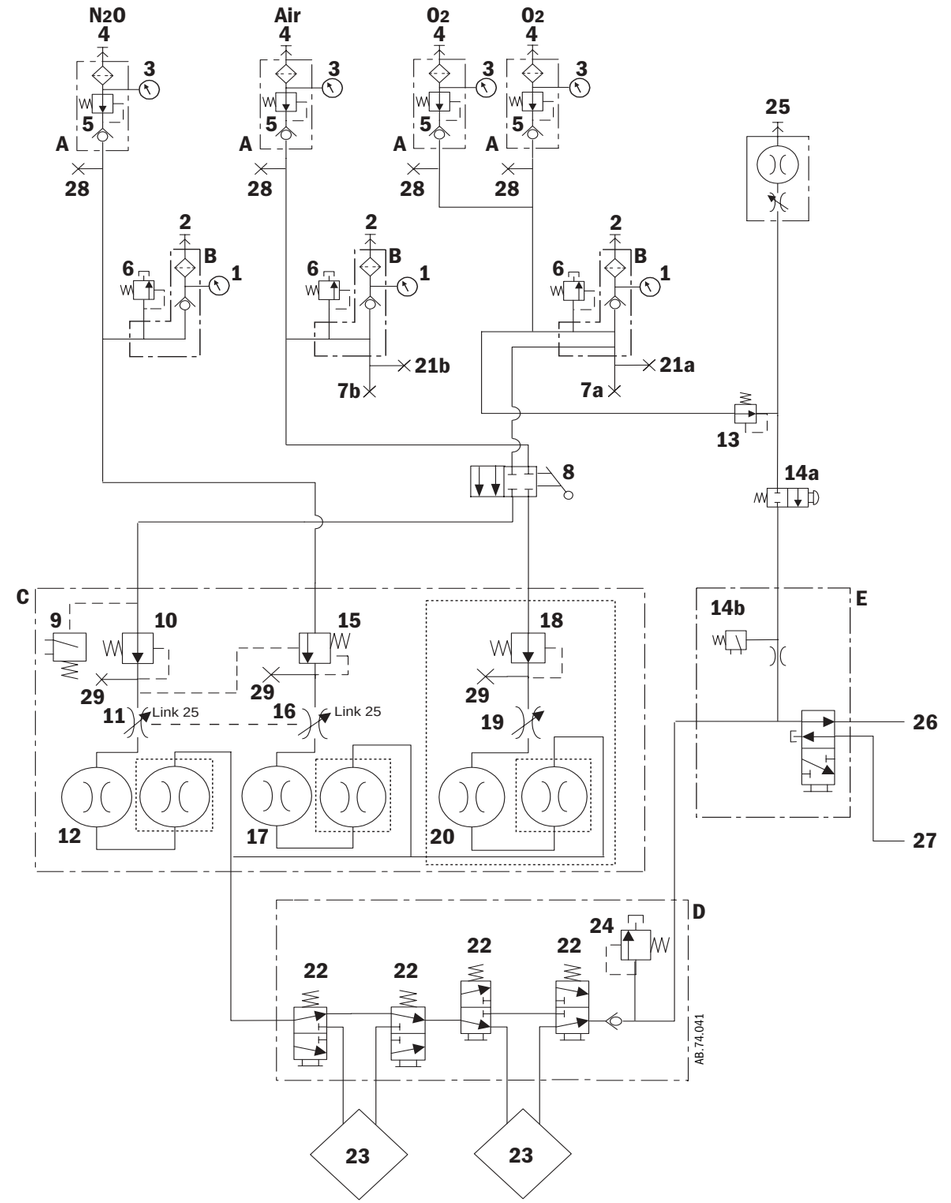
Key to Symbols

Pneumatic Connection

Filter

Direction of Flow

Check Valve



A. Cylinder Supplies
B. Pneumatic Manifold
C. Flowmeter Head
D. Vaporizer Manifold
E. ACGO Select Switch

Figure 9-4 ▪ Pneumatic circuit diagram

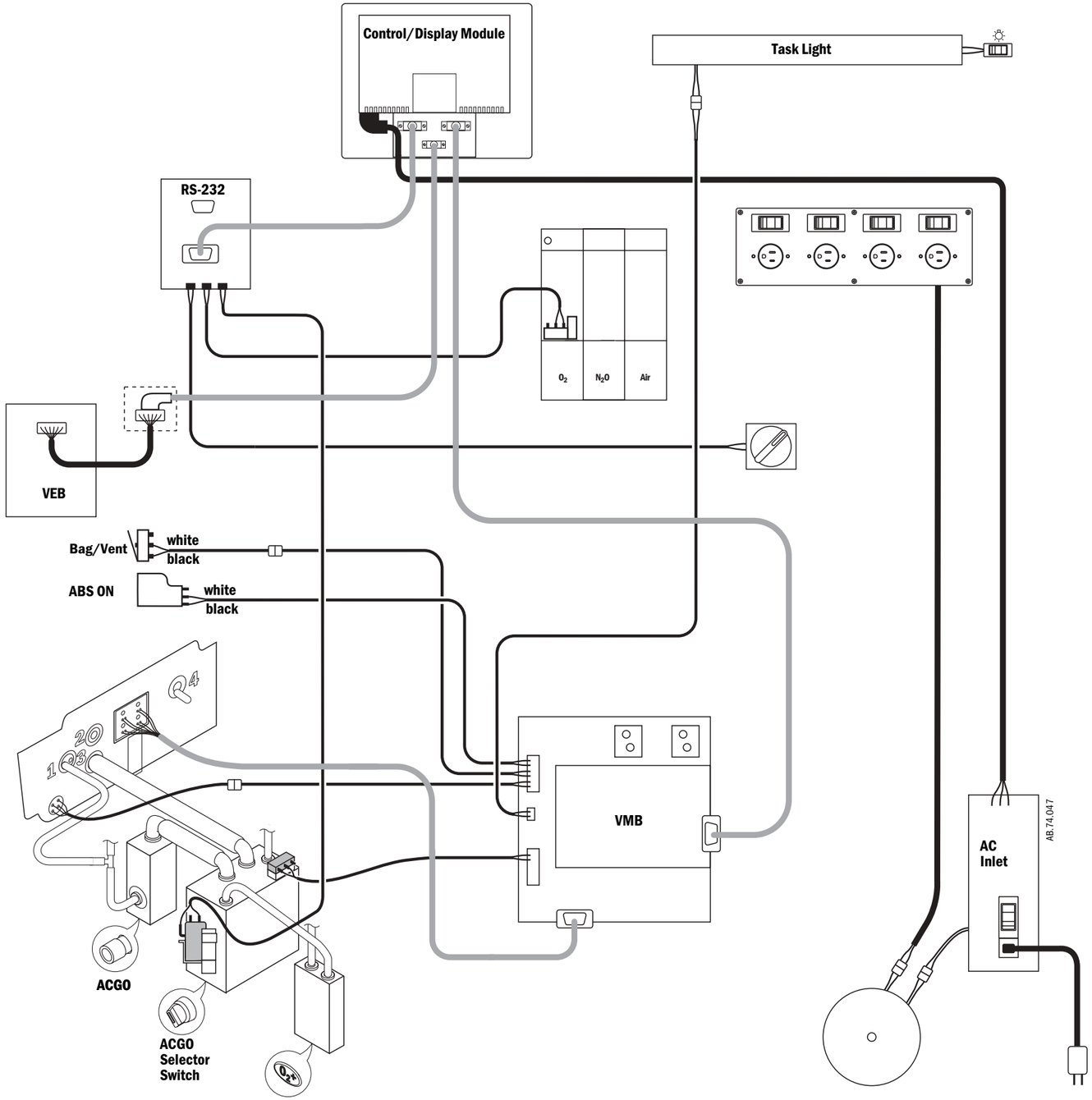


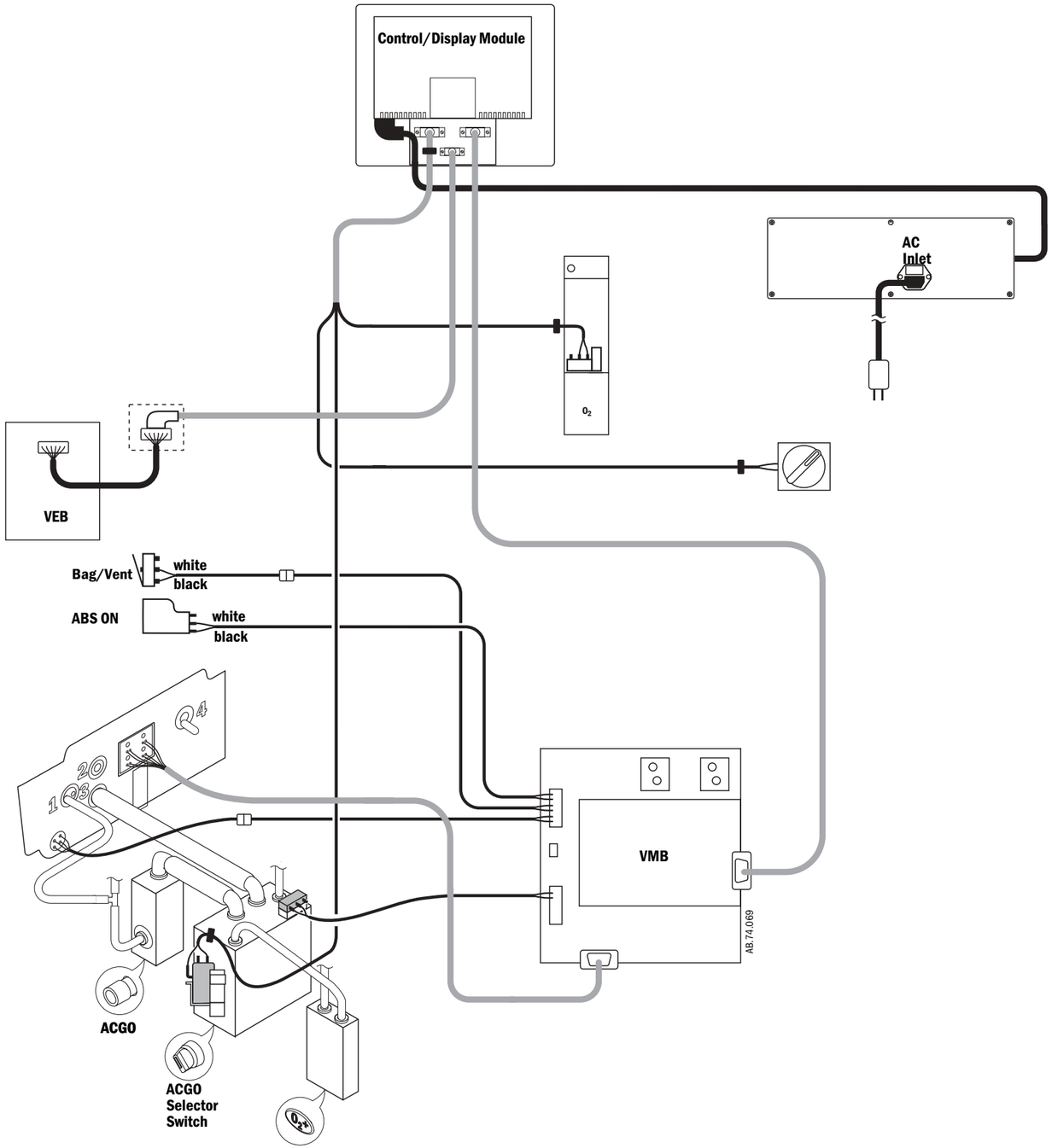
Figure 9-5 ▪ Wiring harnesses

Key to Symbols

VEB = Vent Engine Board

VMB = Ventilator Monitoring Board

ACGO = Auxiliary Common Gas Outlet



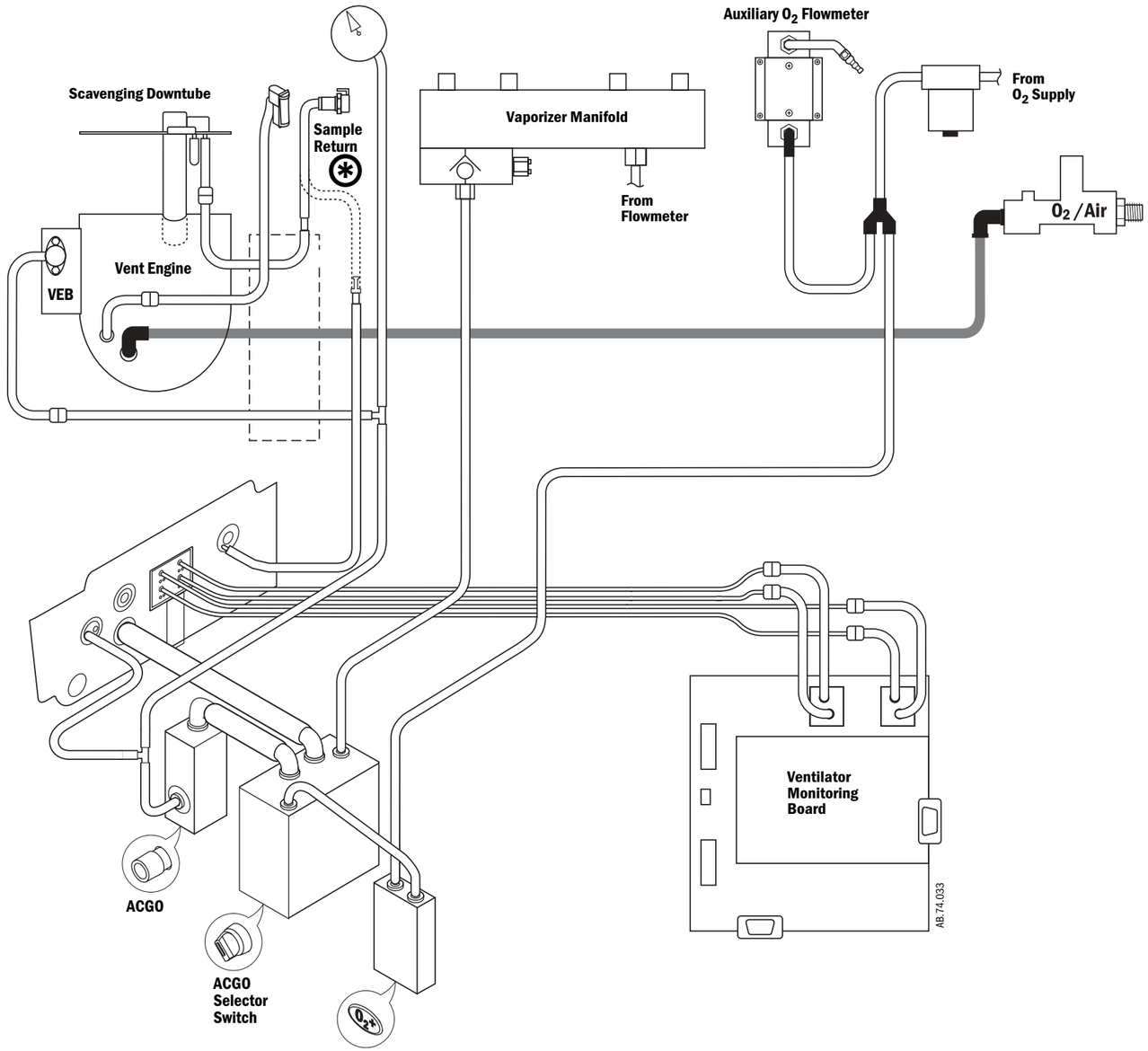
Key to Symbols

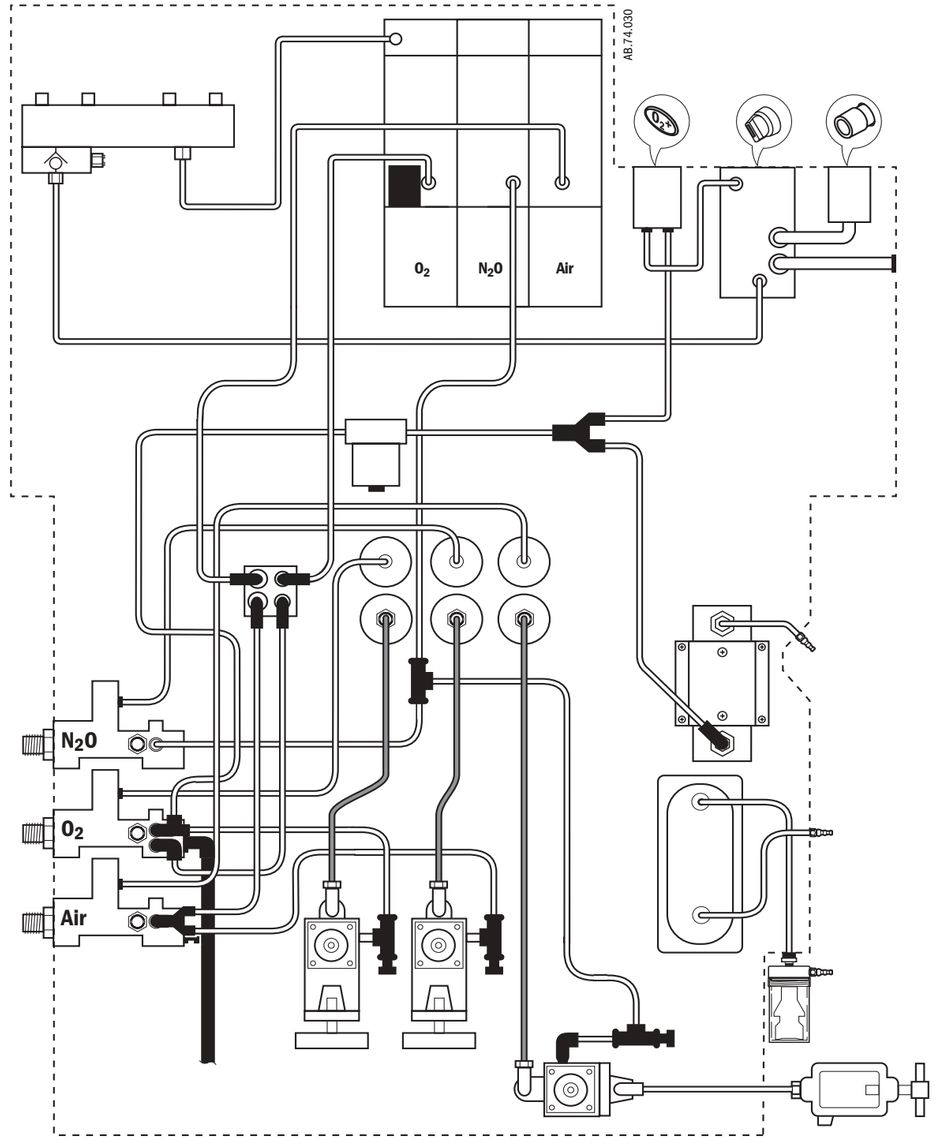
VEB = Vent Engine Board

VMB = Ventilator Monitoring Board

ACGO = Auxiliary Common Gas Outlet

Figure 9-6 ▪ Wiring harnesses (Aespire 100)





The Sample Gas Return is directed to the scavenging system as a factory default. A qualified service representative can reroute the sample gas back to the breathing system. Refer to Section 4.13.

Figure 9-7 • Tubing

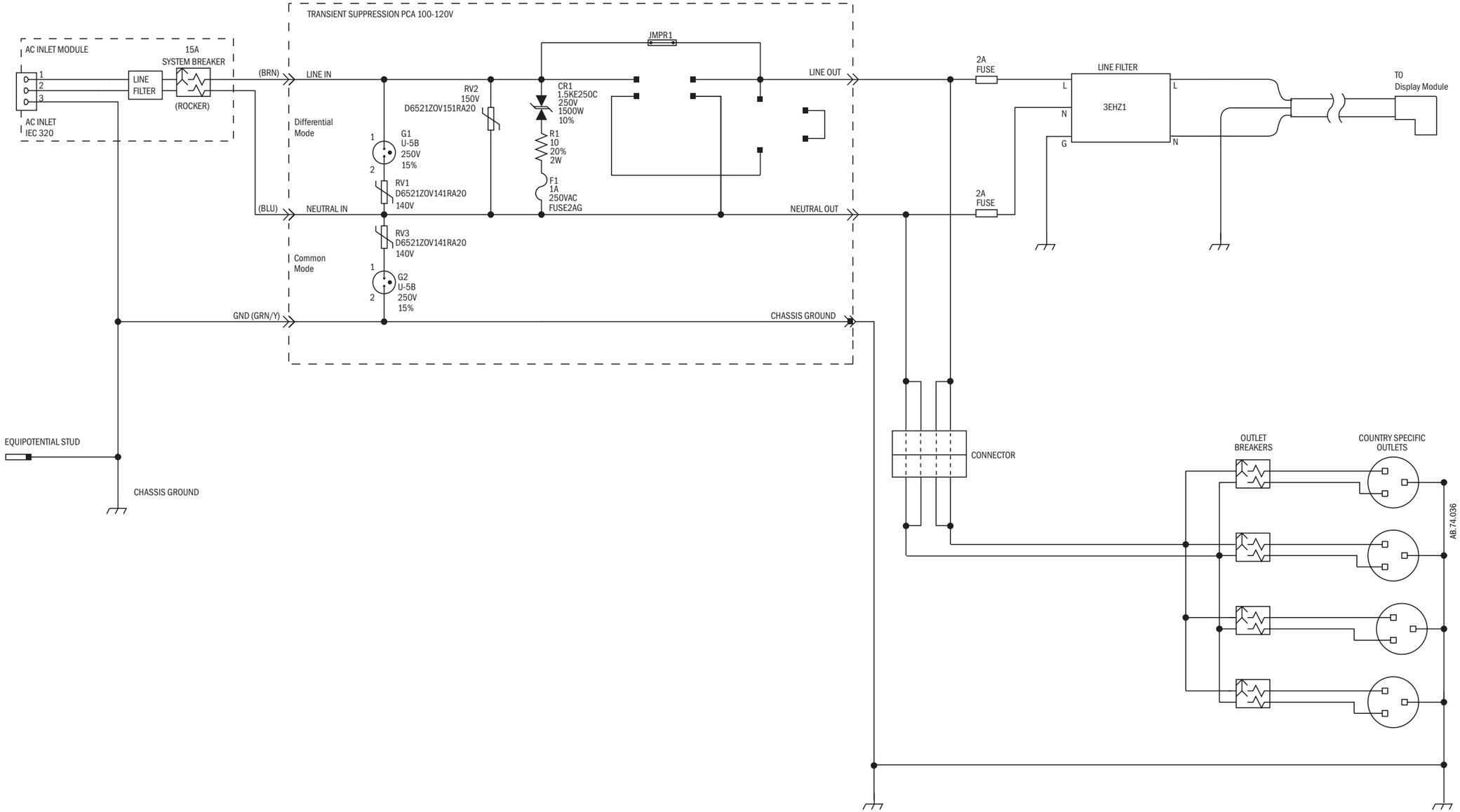


Figure 9-8 ▪ Schematic, AC Inlet module; 100–120 V (Non-isolated outlets or no outlets)

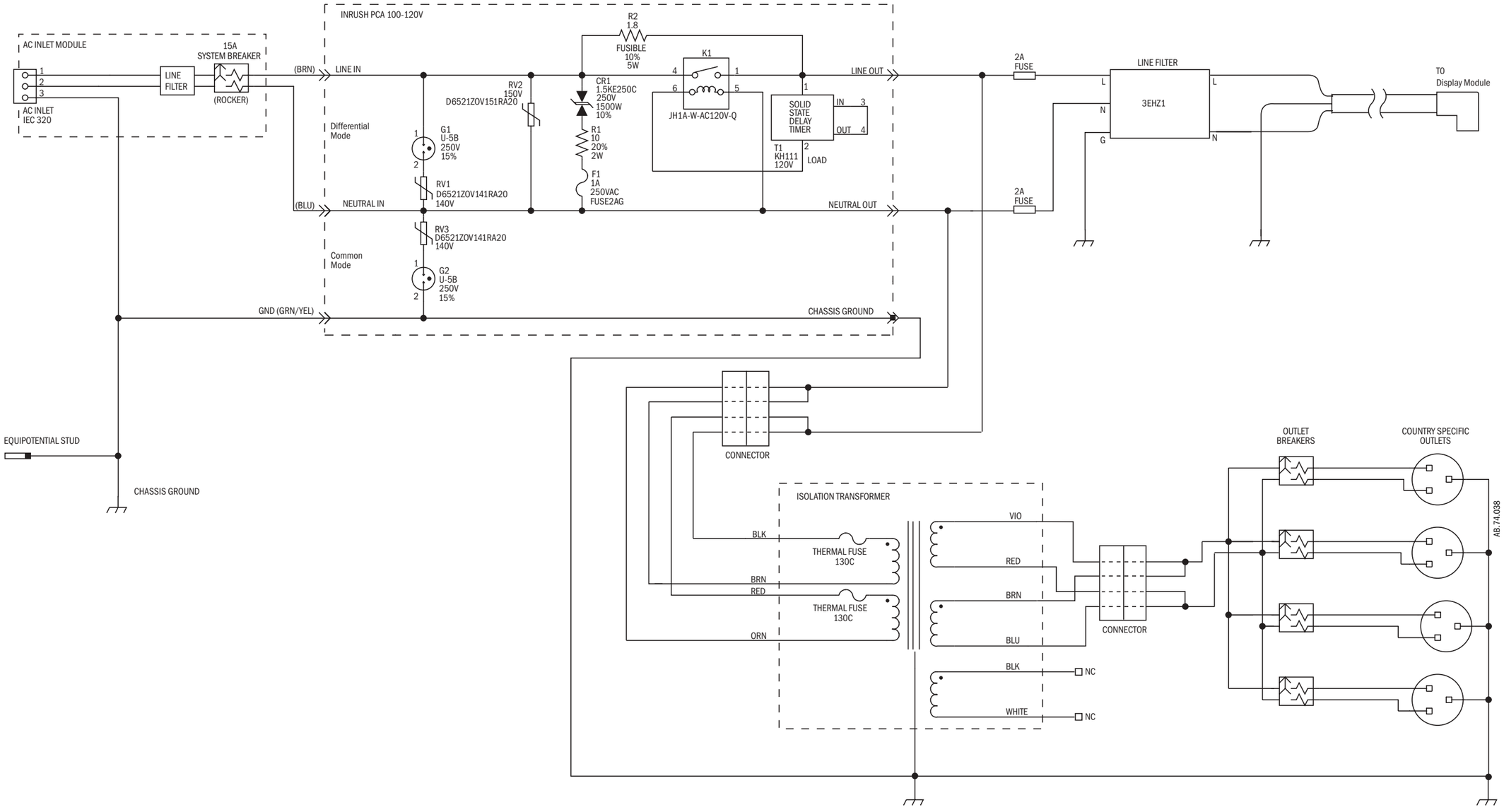


Figure 9-9 ▪ Schematic, AC Inlet module; 100–120 V (Isolated outlets)

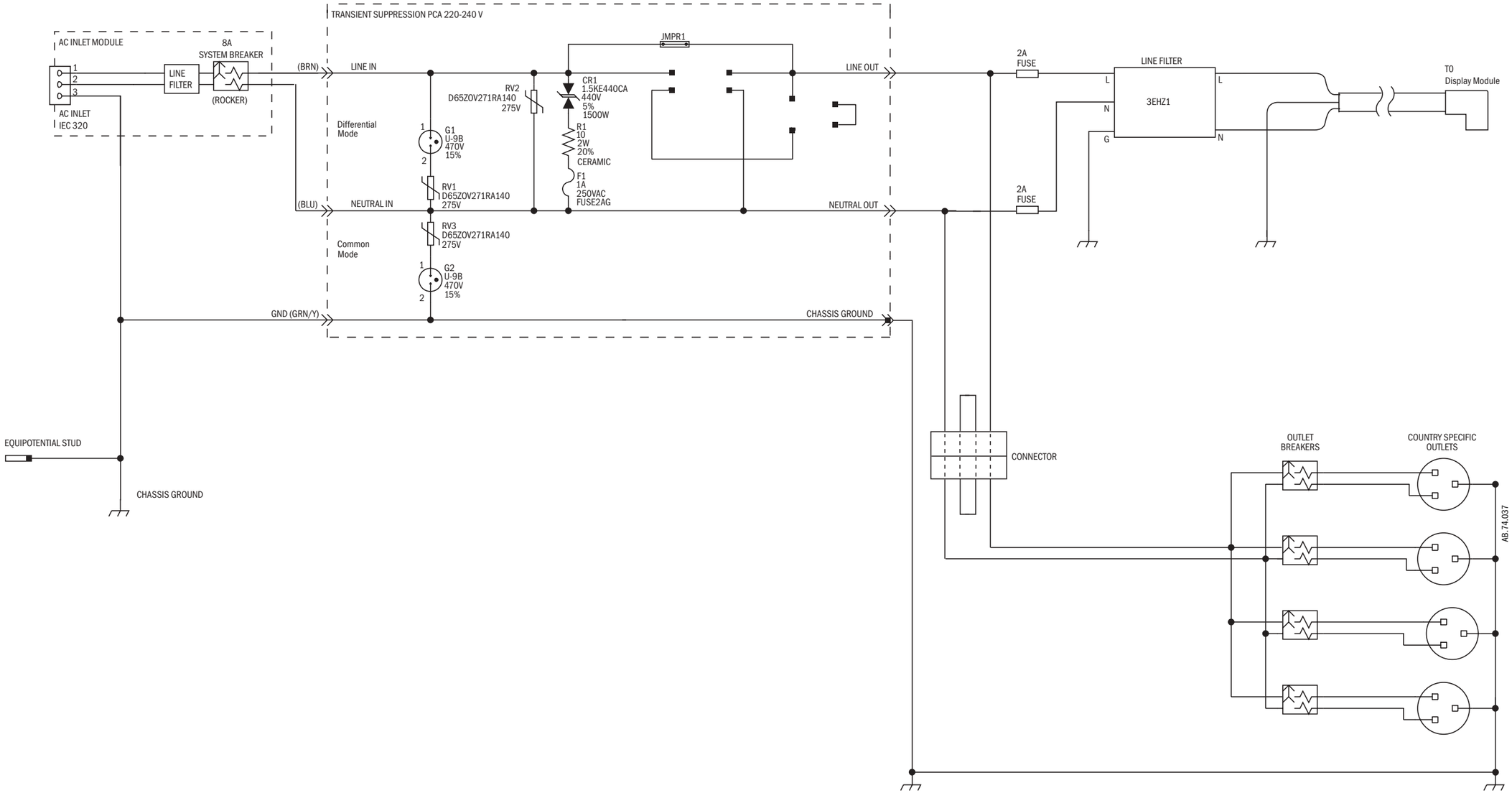


Figure 9-10 ▪ Schematic, AC Inlet module; 220–240 V (Non-isolated outlets or no outlets)

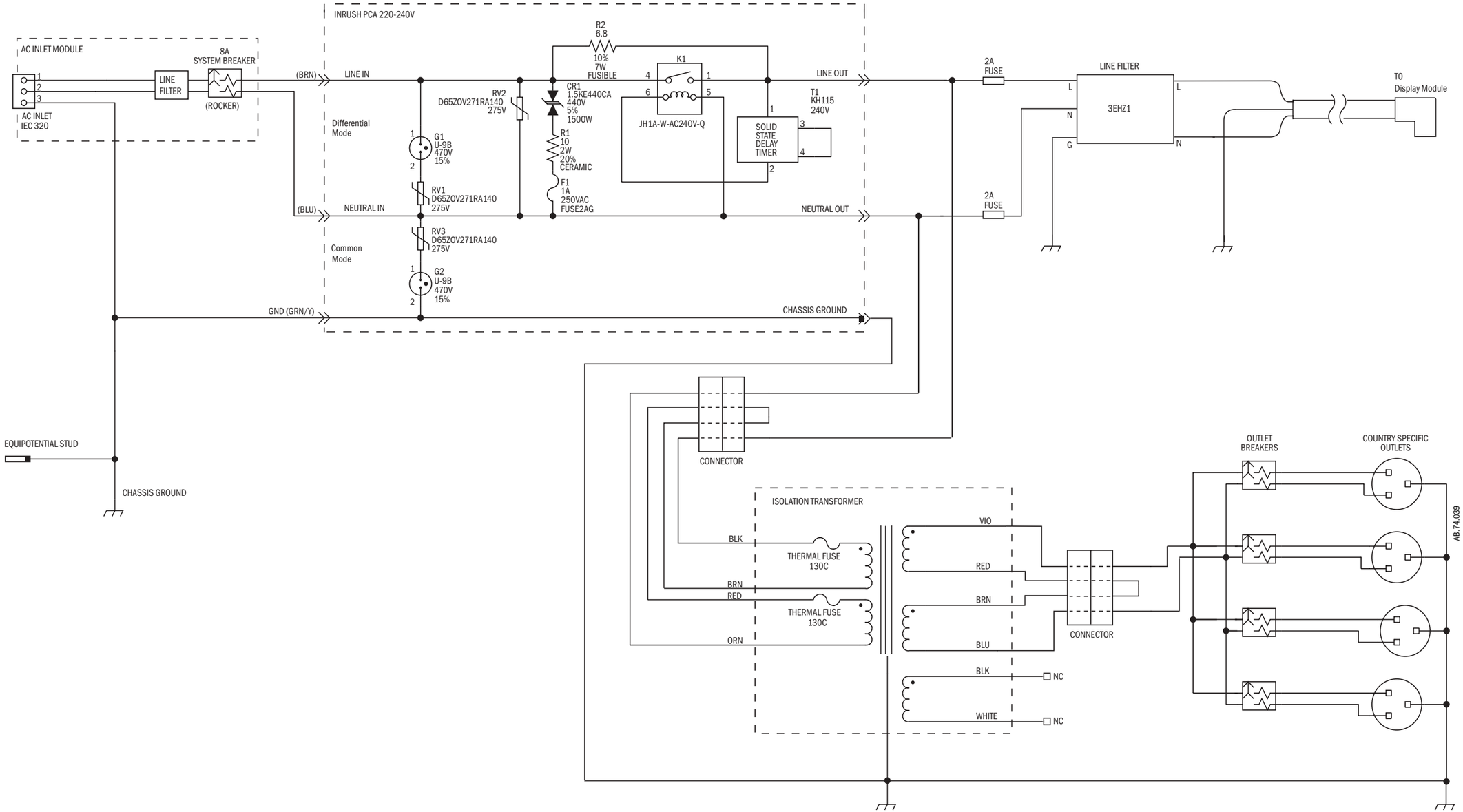


Figure 9-11 ▪ Schematic, AC Inlet module; 220–240 V (Isolated outlets)

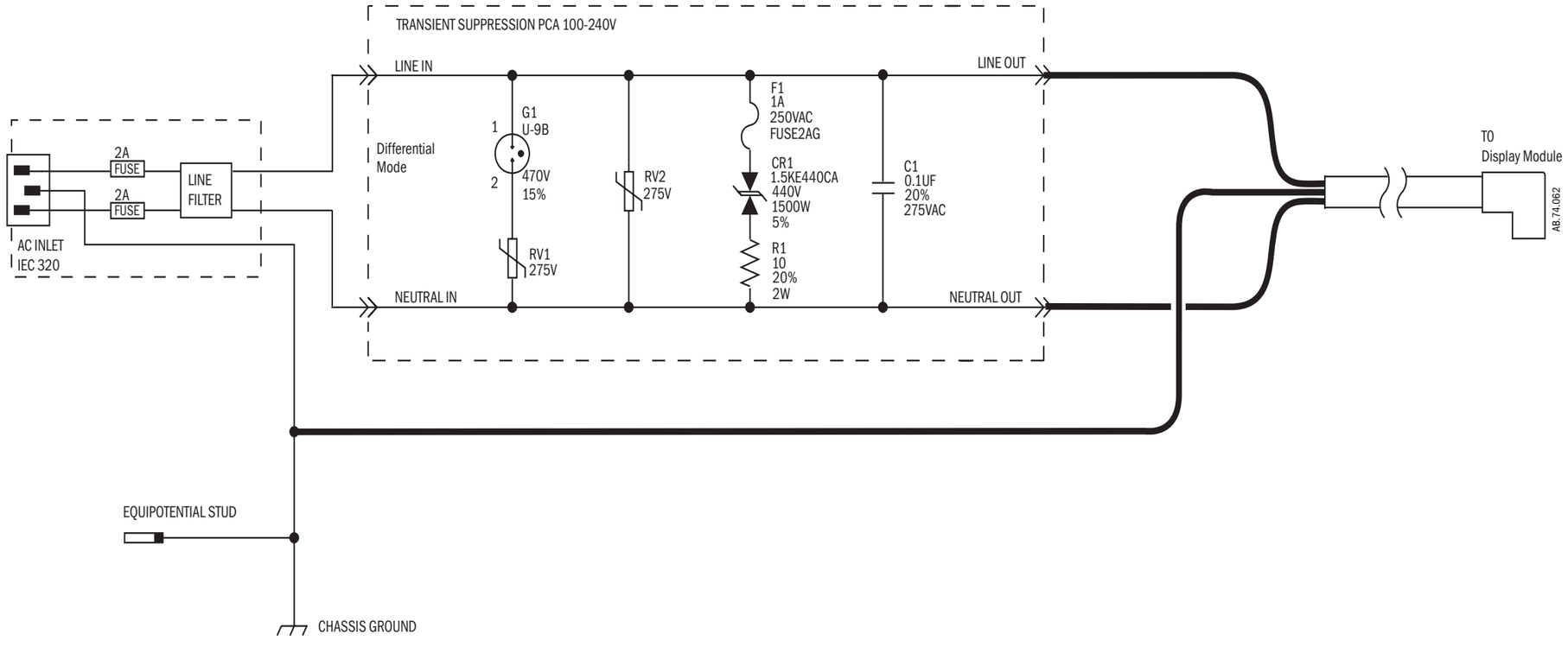


Figure 9-12 • Schematic, AC Power (Aespire 100)

Notes

S/5 Aespire Machine
Technical Reference Manual, English
1009 0356 000
07 04 B 01 01 02
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